PRELIMINARY
INSTRUCTION MANUAL

MODEL 172A
PROGRAMMABLE SIGNAL SOURCE

(WITH OPTION 004)

WAVETEK
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INSTRUCTION MANUAL

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Option 004, 154/157 Emulator, data are included in the rear of this manual.

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SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

WARNING notes call attention to possible injury or death hazards in subsequent operation.

CAUTION notes call attention to possible equipment damage in subsequent operations.

Figure i – Model 172A Programmable Signal Source

SECTION 1
GENERAL DESCRIPTION

1.1 THE MODEL 172A AND OPTIONS

1.1.1 Standard Model

The standard Model 172A is a remote controlled 0.1 mHz to 13 MHz function generator whose functions are sine, square, triangle, pulse, ramps, haversine, havertriangle (see figure 1-1) and dc with 3 digit frequency, amplitude and dc offset amplitude resolution. Frequency, amplitude, function, function symmetry, dc offset, mode, 50Ω load in/out and output on/off are programmable. The frequency may also be controlled by a remote ac or dc voltage for sweep, FM and frequency shift keying operation. The output frequency of the generator may be phase locked to a supplied reference signal for a phase coherent output signal. The generator output may be continuous, triggered for one cycle (by external signal keyboard or program) or gated for a burst of cycles by an external signal. The output signal may be offset by a dc voltage or inverted 180 degrees. The waveform symmetry may be varied from 10 to 90% in 10% steps for variable duty cycle pulses, sawtooth ramps and nonsymmetrical sine waves. A TTL level signal at generator frequency is output for synchronizing purposes. Standard programming is by a Wavetek synchronous, ASCII language bus which utilizes an 8-bit parallel, byte serial data stream. Up to nine Wavetek instruments may be connected in the Wavetek bus, with each instrument having its own unit address, and all instruments addressable by a controller.

1.1.2 Synthesizer Option

The Synthesizer Option provides 5½ digit frequency resolution with 0.0005% accuracy, low phase noise and low spurious content. The internal 10 MHz reference is also output as a TTL pulse for synchronous operation. An external 10 MHz reference may be substituted for the internal reference.

1.1.3 GPIB Option

A General Purpose Interface Bus (GPIB) option allows the Model 172A to be programmed in accordance with the IEEE 488-1975 standard, an asynchronous handshake scheme. This card mounted option is simply placed in a pre-provisioned card connector within the instrument, and a special connector and address switch are placed on the rear panel. The standard Wavetek bus connector remains active, allowing up to nine additional Wavetek instruments to be placed on a subbus controlled via the GPIB bus.

1.1.4 Front Panel Option

The front panel option, an instrument mounted keyboard and 40 character display, gives local control of the instrument and control of other instruments that may be on the common bus. The display shows the values being programmed and the status of the instrument parameters when in either local or remote control.

1.1.5 Stored Program Option

The stored program option allows permanent or temporary storage of up to 100 instrument settings by use of Programmable Read Only Memory (PROM) and Random Access Memory (RAM).

1.1.6 154 or 157 Emulator Option

The 154 or 157 emulator option allows BCD parallel programming of the Model 172A for the programmable parameters associated with the Model 154 or 157. Programming connectors are 154/157 compatible. A serial Wavetek bus connector remains active and full utilization of the 172A is possible via the Wavetek bus or front panel.

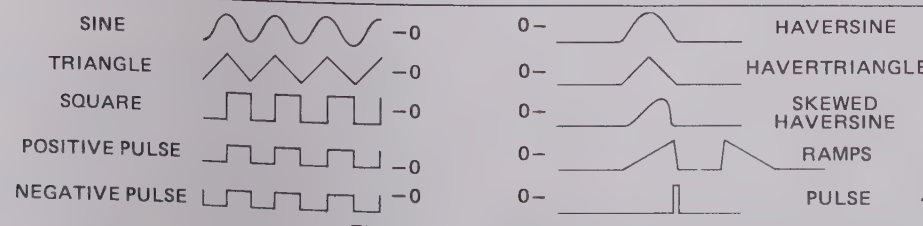


Figure 1-1. Waveforms

1.1.7 Amplitude Conversion Option

The amplitude conversion option allows sine wave amplitude programming in convenient dBm and rms values, as well as volts peak-to-peak into a 50Ω load.

1.1.8 Slide Option

The slide option allows the rack mounted 172A to be accessible for calibration, modification and repair. The slides conform to standard 19 inch rack requirements.

1.2 SPECIFICATIONS

1.2.1 Versatility

Waveforms
Sine ∿ , square ⊓ , triangle △ , pulse ⎍ , ⎎ , ramps ◿ , ◺ , haversine ⩕ , havertriangle ⩓ and dc.

Operational Modes
Synthesizer: A closed loop mode locking the generator to a synthesizer for frequency accuracy and stability. See Option 002.

Phase Lock: Generator locks to an external 10 Hz to 13 MHz signal when programmed within 2% of the external frequency.

NOTE

The following modes are open loop; frequency of generator is not locked to a reference signal. Generator frequency is controlled by external VCG or FM voltage as well as programming.

Continuous: Generator runs continuously.

Triggered: Generator is quiescent until triggered by an external signal or manual trigger, then generates one cycle at selected frequency.

Gated: As triggered mode, except generator oscillates for the duration of the gate signal plus the remainder of the waveform in progress.

Triggered Haverwave: As triggered mode, except output is a sine or triangle waveform starting at –90°.

Gated Haverwave: As gated mode, except output is a sine or triangle waveform starting at –90°.

Frequency Range
0.0001 Hz to 12.99 MHz.

Resolution
3 digit resolution standard. Also see Option 002.

Main Output
∿ , ⊓ , △ , ◿ , ◺ , ⩕ , ⩓ variable to 30V p-p (15V p-p into 50Ω load) with 3 digit resolution. ⎍ and ⎎ variable to ±15V p-p (7.5V p-p into 50Ω load) with 3 digit resolution. Composite waveform/offset not to exceed ±7.5V peak into 50Ω load. 50Ω source impedance with selectable internal 50Ω load.

DC Offset and DC Voltage Output
0 to ±7.5 Vdc into 50Ω, 3 digit resolution. DC offset is attenuated by amplitude range attenuator.

Auxiliary Output
TTL pulse at generator frequency.

Phase Lock Input
Input: TTL level.
Range: 10 Hz to 13 MHz.

VCG — Voltage Controlled Generator
In open loop modes the frequency can be controlled by an external voltage for sweeping or for frequency modulation (FM). A 5V signal will change the frequency over the entire control range of 1000:1, three full decades. On ranges below 10 Hz, control is limited to 10:1.

Input Signal Bandwidth: 50 kHz for small signal ($\Delta V = 0.5V$).

Input Impedance: 5 kΩ.

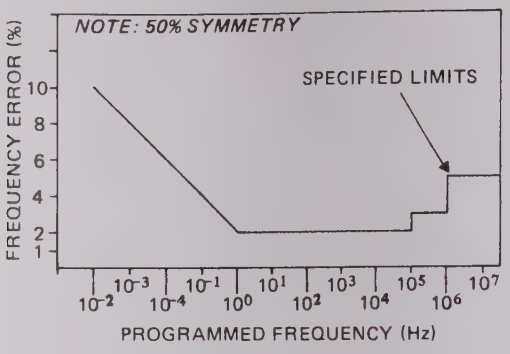
Symmetry Control
Waveform symmetry variable from 10 to 90% in 10% steps (50% is symmetrical). Varying symmetry provides variable duty cycle pulses, sawtooth ramps and unsymmetrical sine waves. Symmetry control is available for frequencies to 999,990 Hz.

Trigger Input
In triggered, gated, triggered haverwave and gated haverwave modes, a TTL (low true) compatible pulse or contact closure will trigger or gate the generator.

Data Entry
Bit parallel, byte serial, ASCII character remote programming and optional front panel keyboard/display. See Option 001. To address load and execute each command requires 80 to 100 ms. If all commands are loaded into the buffers during wait time, then executed with a group execute trigger, execution time is 2 ms.

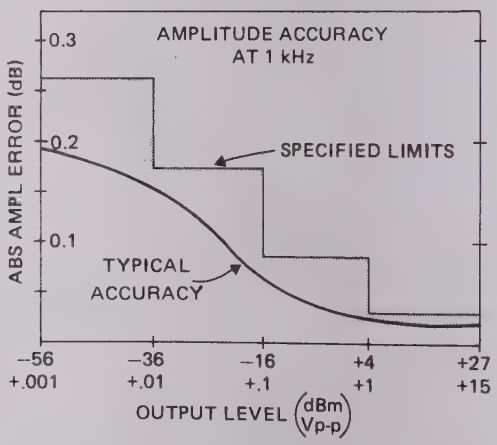
1.2.2 Frequency Precision

Open Loop Accuracy
(For synthesizer accuracy, see Option 002.)

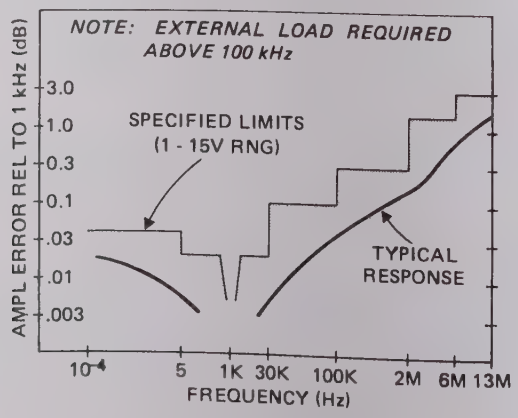


1.2.3 Amplitude Precision

Accuracy
Specified for 1 kHz sine wave and dc voltage output with internal 50Ω load, greater than 1 MΩ external impedance.



Frequency Response (sine wave, relative to 1 kHz signal)



NOTE

⊓⊔ and ∿ accuracy are within 0.2 dB of sine wave accuracy.

Amplitude Resolution

Range	Resolution
10.00 to 14.99V	10 mV
1.00 to 9.99V	10 mV
100 to 999 mV	1 mV
10.0 to 99.9 mV	0.1 mV
1.00 to 9.99 mV	10 μV

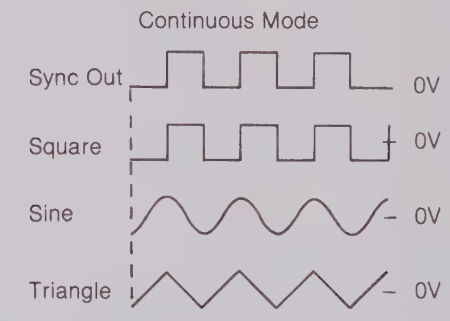
1.2.4 Waveform Characteristics

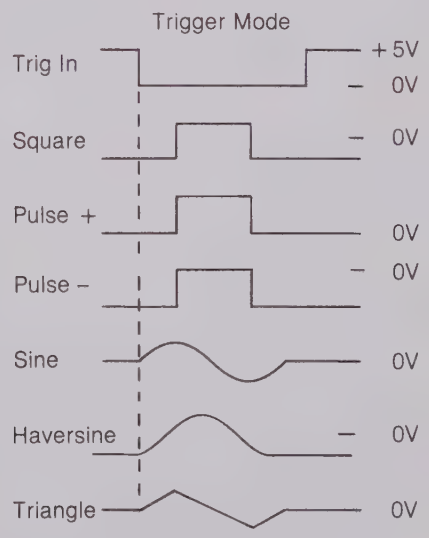
Sine Distortion (continuous mode, 2.82V p-p test level)
Total harmonics referenced to carrier are −46 dB to 30 kHz. Each harmonic reference to carrier is less than:

−40 dB to 1 MHz
−30 dB to 13 MHz

Square Wave Rise and Fall Time
Less than 20 ns (typically 15 ns).

Waveform Timing Diagram





NOTE

Minus amplitude shifts all signals except sync by 180° and shifts baseline to opposite polarity.

1.2.5 General

Stability (measured at 25 ±1°C)

Amplitude and DC Offset

Short Term: 0.025 dB for 15 minutes.
Long Term: 0.05 dB for 6 months.

Frequency

Short Term: 0.3% for 15 minutes.
Long Term: 1.0% for 8 hours (to 1 MHz).

See Option 002 for synthesizer stability.

Environmental
Specifications apply for 25 ±10°C after ½ hour unless otherwise noted. Instrument will operate from 0 to 45°C to 10,000 foot altitude at 95% relative humidity.

Dimensions
Fits standard 48.3 cm (19 in.) rack. 43.2 cm (17 in.) wide; 13.3 cm (5¼ in.) high; 58.4 cm (23 in.) deep. Supplied with rack mount adapters. Slides available; see Option 007.

Weight
26.3 kg (58 lb) net; 30.8 kg (68 lb) shipping.

Power
90 to 105V, 108 to 126V, 198 to 231V or 216 to 252V; 48 to 67 Hz; less than 200 watts.

1.2.6 Options

001: Display and Control Front Panel
This option includes a keyboard entry front panel and a 40 character alphanumeric display. The keyboard allows you to manually control all instrument parameters. The alphanumeric display indicates the values being programmed and also shows the status of the instrument when in the remote mode.

002: 5½ Digit Synthesizer
Provides synthesizer accuracy for any waveform selected. The following specifications apply.

Frequency

10 Hz to 12.9999 MHz.

Frequency Resolution

Range	Resolution
10 to 99.999 Hz	1 mHz
100 to 999.99 Hz	10 mHz
1 to 9.9999 kHz	0.1 Hz
10 to 99.999 kHz	1 Hz
100 to 999.99 kHz	10 Hz
1 to 9.9999 MHz	100 Hz
10 to 12.9999 MHz	100 Hz

Settling Time

Frequency reaches full accuracy 2 ms and 50 cycles after execution.

Accuracy

Better than 0.0005% of program setting.

Frequency Stability

Short Term: $\pm 1 \times 10^{-7}$ of frequency per day.
Long Term: $\pm 1 \times 10^{-6}$ of frequency per month.
Temperature: 1.2×10^{-7} per °C.

Signal To Phase-Noise

Greater than 40 dB in a 30 kHz band centered on carrier but excluding a ±1 Hz band around the carrier.

Spurious

For spurious signals in the range of 400 Hz to 110 MHz, spurious levels are:

172A Frequency Range	Max Spurious Signals (greater value applies)
10 Hz to 999.99 kHz	–60 dB or 40 μV
1 kHz to 4.9999 MHz	–55 dB or 40 μV
5 to 12.9999 MHz	–50 dB or 40 μV

Internal Reference Output

10 MHz TTL compatible signal.

External Reference Input

An external sine or square wave within ±3 ppm of 10.0 MHz, 1 to 10V rms and 50 ±8% duty cycle will automatically replace the internal reference.

003: Internal Stored Program
Provides internal program Random Access Memory (RAM). RAM is erased by turning off power and may be reprogrammed. Up to 100 instrument settings may be stored and recalled via the front panel or by remote control. Additional custom PROM storage may be added to this option.

004: Models 154 and 157 Programming
The Model 172A can emulate the programming format, input levels and connector of our earlier Models 154 and 157 Programmable Function Generators.

005: GPIB Programming
Provides General Purpose Interface Bus (GPIB) programming fully compatible with IEEE Standard 488-1975. This allows the 172A to be directly connected to the GPIB. The interface is isolated from the generator with optical couplers.

006: Amplitude Output Conversion
Permits programming of the sine wave output amplitude in units of volts - root mean square (Vrms) and decibels relative

to one milliwatt (dBm) in addition to the standard units of volts peak-to-peak.

Vrms Range: 1 mV to 5.30V.

dBm Range: –56 to +27.4 dBm.

007: Rack Slides

SECTION 2
INSTALLATION AND INTERFACE

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

The generator can be used as a bench instrument or rack mounted. In either use, ensure that there is no impedance to air flow at any surface of the instrument.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 120 Vac line supply and with a 3 amp fuse.

Conversion to other input voltages requires a change in rear panel fuse-holder voltage card position and fuse according to the following procedure.

Card Position	Input Vac	Fuse
100	90 to 105	3 amp
120	108 to 126	3 amp
220	198 to 231	1.5 amp
240	216 to 252	1.5 amp

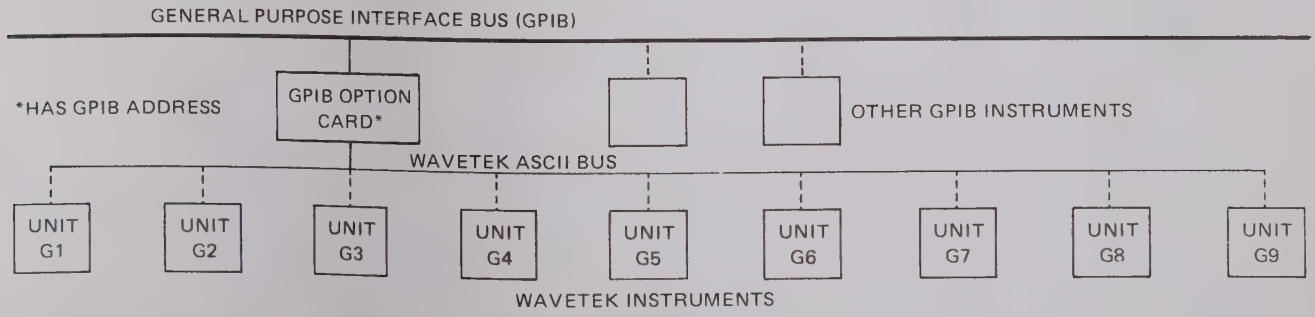
1. Open fuse holder cover door and rotate fuse pull to left to remove the fuse.
2. Select operating voltage by orienting the printed circuit board to position the desired voltage on the top left side. Push the board firmly into its module slot.
3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.
4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

Use RG58U 50Ω shielded cables equipped with BNC connectors to distribute 50Ω OUT, SYNC OUT, TRIG IN, VCG (FM) IN, ϕ LOCK IN, REF IN and REF OUT signals when connecting this instrument to associated equipment.

2.2.3 Busses

There is provision for two programming busses on the 172A: the Wavetek ASCII bus, a synchronous data bus, and the General Purpose Interface Bus (GPIB), an asynchronous data bus. The Wavetek bus is standard and always usable, even when the optional GPIB is operational. The GPIB option card, when installed, acts as a translator from the GPIB to the Wavetek bus. The latter may interconnect more than one Wavetek instrument, as shown in figure 2-1.



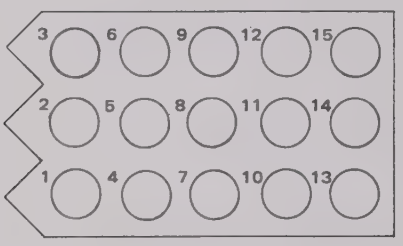
NOTE: The GPIB address enables only the GPIB option card (translator). Individual Wavetek units must also be addressed for control.

Figure 2-1. The GPIB and Wavetek Bus

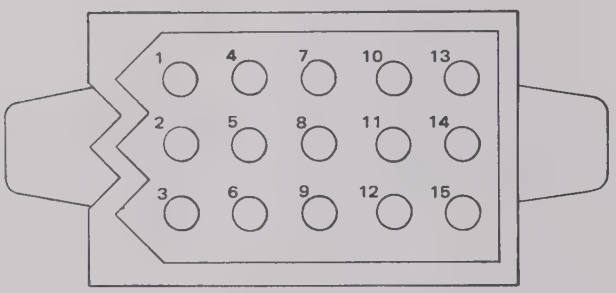
2.2.4 Wavetek Bus Connections

The remote (ASCII DATA IN/OUT) rear panel connection, pin connections and signal names are given in table 2-1.

The remote connector is a Molex 03-09-1151 (figure 2-2) which mates with a Molex 03-09-2151 connector housing with up to 15 Molex 02-09-2118 pin contacts. Pin contacts are prepared using a Molex Model A6973 crimping tool to connect No. 18 or No. 22 wire (strip back 1/10 to 1/8 inch).



MOLEX 03-09-1151



MOLEX 03-09-2151

Figure 2-2. Wavetek Bus Connectors (Socket/Pin Sides)

Table 2-1. Wavetek Bus Connector Pin Assignments

Pin	Signal*	Pin	Signal*
1	PCOM	9	XD4
2		10	XD3
3	KINH	11	XD1
4		12	XD5
5		13	XD0
6	BUSY	14	XD6
7	COM	15	XCLK
8	XD2		

*ASCII Data In/Out (Rear Panel)

PCOM: Program/Signal Common (172A Wavetek Bus cannot be Program Common/Signal Common Isolated)
KINH: Keyboard Inhibit

Table 2-1. Wavetek Bus Connector Pin Assignments (Cont)

BUSY: Not Ready for New Data
X: External
D: Data
0 - 6: Bits 0 thru 6
CLK: Clock
K: Keyboard
NC: No Connection

True = Low
False = High
TTL Voltage Level

2.2.5 Unit Address

Unless otherwise specified, the Model 172A is delivered with a unit address of 1. This address can be changed by repositioning the switches on the address chip of the microprocessor board (figure 2-3). To change the unit address, turn power off, remove the top cover and the microprocessor board -0647 by pressing on the outboard and lifting on the inboard sides of the two board lifters.

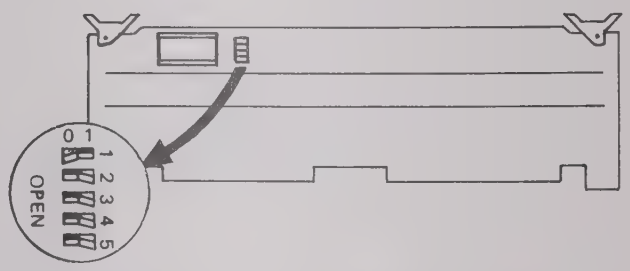


Figure 2-3. Address Chip on the Microprocessor

The five sections of the switch are each switchable as 1 or 0 and the following combinations form their respective addresses (OPEN = Binary "0").

Address	Section 54321
1 =	00001
2 =	00010
3 =	00011
4 =	00100
5 =	00101
6 =	00110
7 =	00111
8 =	01000
9 =	01001

All other addresses are invalid. Set the address as desired by pressing the 0 or 1 for each section and replace the board and cover.

Table 2-2. GPIB Data In/Out

Pin	Signal	
1	DIO1	True When Low
2	DIO2	
3	DIO3	
4	DIO4	
5	EOI	
6	DAV	
7	NRFD	True When High
8	NDAC	
9	IFC	True When Low
10	SRQ	
11	ATN	
12	Safety Gnd	
13	DIO5	True When Low
14	DIO6	
15	DIO7	
16	DIO8	
17	REN	
18		Signal Gnd
19		
20		
21		
22		
23		
24		

2.2.6 GPIB Connections (Option 005)

The GPIB I/O rear panel connection is shown in figure 2-4; pin connections and signal names are given in table 2-2. The panel connector is an Amphenol 57-10240 or equivalent and connects to a GPIB bus cable connector (available from Wavetek in 1m and 2m lengths). The GPIB interface is optically isolated from the instrument.

Figure 2-4. GPIB Panel

2.2.7 GPIB Card Address

For instruments on the General Purpose Interface Bus (GPIB), ensure that the GPIB address and the individual instrument unit address are correct. The GPIB option can act as a translator for up to nine Wavetek instruments, so the GPIB and instrument addresses are independent of one another. (See figure 2-1.)

The GPIB address can be changed by the switch on the rear of the instrument (see figure 2-4) by simply setting the multiple section switch located on the rear panel according to table 2-3. The switch sections are labeled from 1 thru 5 and their open position noted (OPEN = Binary "0" in table 2-3). To verify the address, press ADR on the front panel. The device number (decimal) will be displayed as: "GPIB = (0, 1, - - - 30)".

Table 2-3. GPIB Address Codes

Device	Address								
	ASCII		Binary*					Hexadecimal	
	Listen	Talk	5	4	3	2	1	Listen	Talk
0	(space)	@	0	0	0	0	0	20	40
1	!	A	0	0	0	0	1	21	41
2	"	B	0	0	0	1	0	22	42
3	#	C	0	0	0	1	1	23	43
4	$	D	0	0	1	0	0	24	44
5	%	E	0	0	1	0	1	25	45
6	&	F	0	0	1	1	0	26	46
7	'	G	0	0	1	1	1	27	47
8	(	H	0	1	0	0	0	28	48
9	)	I	0	1	0	0	1	29	49
10	*	J	0	1	0	1	0	2A	4A
11	+	K	0	1	0	1	1	2B	4B
12	,	L	0	1	1	0	0	2C	4C
13	–	M	0	1	1	0	1	2D	4D
14	.	N	0	1	1	1	0	2E	4E
15	/	O	0	1	1	1	1	2F	4F
16	0	P	1	0	0	0	0	30	50
17	1	Q	1	0	0	0	1	31	51
18	2	R	1	0	0	1	0	32	52
19	3	S	1	0	0	1	1	33	53
20	4	T	1	0	1	0	0	34	54
21	5	U	1	0	1	0	1	35	55
22	6	V	1	0	1	1	0	36	56
23	7	W	1	0	1	1	1	37	57
24	8	X	1	1	0	0	0	38	58
25	9	Y	1	1	0	0	1	39	59
26	:	Z	1	1	0	1	0	3A	5A
27	;	[	1	1	0	1	1	3B	5B
28	<	\	1	1	1	0	0	3C	5C
29	=	]	1	1	1	0	1	3D	5D
30	>	↑	1	1	1	1	0	3E	5E
			Switch Settings 0 = Open						

*The 6th and 7th bits which define the ASCII codes are used to specify whether a listen or talk address is being sent. Bits 1 thru 5 are matched against the rear panel address switch.

NOTE

Address 31 is not allowed.

SECTION 3
OPERATION

3.1 DATA ENTRY

Using the Model 172A is quite straight forward and is best understood by trial and error method while the microprocessor "converses" with you during operation, informing you what was programmed, what is possible to program and when an error is made. The example of data entry given in table 3-1 will give you the feel of using the 172A. Appendix B gives a summary of programming commands.

The details of power on, command structure and programming are given in paragraphs 3.2 and 3.3. Operation in each mode is discussed in paragraph 3.4. Front panel keyboard and readout are discussed in paragraph 3.5. Program functions peculiar to the GPIB are discussed in paragraph 3.6. These functions are in strict accordance to ground rules set forth in IEEE standard 488-1975. The operation of the stored program option is discussed in paragraph 3.7.

3.2 POWER

Power is turned on and off with a front panel pushbutton. When power is turned on, wait approximately 8 seconds before programming (for front panel option, wait until "WAVETEK MODEL 172A" is displayed). When the power is turned on, the generator is automatically addressed and is ready to accept commands. At least two seconds must elapse between power OFF and power ON for proper re-initialization of logic. If a different generator is to be addressed or other units are to be deselected, program or key the selected unit. (Refer to paragraph 3.3.9.) When the power comes on, the output is automatically disabled to allow loading of a program; line transients on the output are avoided. The generator must get an execute command to provide an output. (Refer to paragraph 3.3.8.)

Table 3-1. Example of Front Panel Data Entry

Instruction	Front Panel Entry (Press Keys)	Front Panel Display	Equivalent Program Entry
1. Power on	[OFF] (becomes ON)	Within a few seconds, WAVETEK MODEL 172A	None
2. Check instrument unit number	[ADR]	UNIT SELECTED (Unit Number). This may be 1, 2, - - - 9 (if the GPIB option is included, the state of the GPIB address switches will also be displayed: GPIB = (decimal address and ASCII listen and talk characters). See paragraph 2.2.5 to change addresses.	G
3. Check initial conditions:			
Output and load	[OUTP]	OUTPUT OFF, 50 OHM LOAD OUT (2)	P
Amplitude	[AMPL]	AMPLITUDE 1 VOLT P-P	A
Offset	[OFST]	OFFSET 0 VOLTS	D
Frequency	[FREQ]	FREQUENCY 1 KILOHERTZ	F
Symmetry	[SYM]	SYMMETRY 50% (0)	S
Function	[FUNC]	FUNCTION IS SINE (0)	C

Table 3-1. Example of Front Panel Data Entry (Continued)

Instruction	Front Panel Entry (Press Keys)	Front Panel Display	Equivalent Program Entry
Mode	MODE	MODE IS CONTINUOUS (0)	B
4. Look at this signal by connecting the output to an oscilloscope with a 50Ω cable	OUTP 1	LOAD 1	P1
5. Display a more descriptive readout of programming (for display only, not necessary in the programming sequence)	OUTP	OUTPUT ON, 50 OHM LOAD IN (1)	P
6. Execute the programming (it will now be available to the oscilloscope)	EXEC	F 1E3 A 1 O 0 (this F__ A__O__ format always comes on with EXEC; in this case, frequency of 1 kHz, amplitude of 1V p-p and offset of 0V is output	I
7. Look at the equivalent program character string	CMD RCL	GPADFSCBP1PIR (these are the equivalent program entries; see the last column in this table)	R
8. Reprogram the instrument:			
Ramp waveform	FUNC 1	FUNCTION 1	C1
	SYM 2	SYMMETRY	S2
5.1 kHz	FREQ 5 · 1 EXP 3	FREQUENCY 5.1 E3	F5.1E3
14.9V p-p	AMPL 1 4 · 9	AMPLITUDE 14.9	A14.9
Offset −1.2 Vdc	OFST − 1 · 2	OFFSET −1.2	D−1.2
9. Initiate these new settings	EXEC	WARNING: Clipping or synthesizer error (with the amplitude of 14.9V p-p and offset of −1.2 Vdc, peaks are 6.25V and −8.65V. Maximum allowable are ±7.5V; the negative peak will be clipped at −7.5V)	I
10. Change amplitude to 12.6V p-p	AMPL 1 2 · 6	AMPLITUDE 12.6	A12.6
11. Initiate these settings	EXEC	F 5.1E3 A 12.6 O −1.2 (no clipping occurs)	I

Refer to paragraph 3.5 for complete front panel data.

3.3 BASIC COMMAND STRUCTURE

The Model 172A is programmed by sending ASCII coded characters (refer to Appendix) to the microprocessor via one of the three possible input ports (keyboard, Wavetek bus or optional GPIB) shown in figure 3-1. If input characters are present on more than one input port, they are read first from the GPIB, next from the Wavetek bus and last from

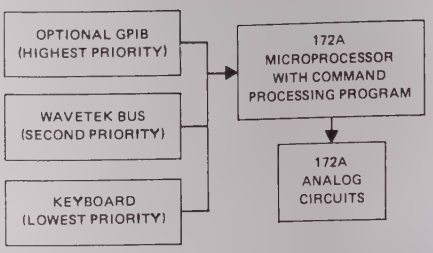


Figure 3-1. Instrument Processing Flow Diagram

the keyboard. Thus, if a high priority port is continuously supplied with characters, then no characters will ever be read from a lower priority port. Additionally, any character generated by pressing a front panel key while the Wavetek bus keyboard lockout signal is off, or any character sent to the instrument from the GPIB, is transmitted from the instrument via the Wavetek bus.

Characters used to program the 172A are divided into classes:

1. Alphabetic characters — The characters A thru Z, except E.

2. Numeric characters — The characters 0 thru 9, E, –, decimal point (.).

3. Special characters — Quote (') and =.

4. Terminator character — Initially the ASCII line feed character (LF). If the GPIB option is installed, this can be changed by programming.

5. Nonprogramming characters — Any character not in one of the above classes.

The alphabetic characters are used to select *actions* or *settings*. An action is a sequence of events which happens immediately when the character which selects it is read by the microprocessor. A setting is a numeric value which may be changed by programming. Table 3-2 lists the alphabetic characters and table 3-3 lists the numeric characters used.

To program an action, simply program the proper alphabetic character from any of the input ports. The action will then take place, but only if the instrument is in the *enabled* state at the moment when that character is read by the microprocessor. (Refer to table 3-4.)

To examine the current value of a setting, simply program the proper alphabetic character from any of the input ports. The current value will then be displayed on the front panel. This occurs whether or not the instrument is enabled. If the character programmed does not correspond to a legal setting in the instrument, nothing happens.

Table 3-2. Alphabetic Characters Used In Model 172A*

ASCII Character	Keyboard Key	Action (A) or Setting (S)	Comments
A	AMPL	S	Amplitude
B	MODE	S	Mode
C	FUNC	S	Function
D	OFST	S	Offset and dc voltage
F	FREQ	S	Frequency
G	ADR	S	Unit addressed and its GPIB address if applicable
I	EXEC	A	Execute
J	TRIG	A	Trigger
M	STOR SET	S	Memorize program (see stored program option, para 3.7.1)
P	OUTP	S	50Ω load and output on/off
Q	SRQ	S	SRQ enable (see GPIB option, para 3.6.2)
R	CMD RCL	A	Recall last 37 programming input characters
S	SYM	S	Symmetry
T	TLK	S	Talk message specify (see para 3.6.4)
V	AMPL DEF SPEC	S	Specify amplitude units (see para 3.3.11)
W	NEXT SET	A	Steps to next higher numbered stored setting
X	TRM	S	Specify terminator character (see para 3.6.6)
Y	RCL SET	S	Recall stored program (see para 3.7.2)
Z	–	S	Fast recall (see stored program option, para 3.7.5)

*Characters not listed are not used.

The numeric characters are used to program new setting values. To change a setting to a new value, first program the alphabetic character which selects the desired setting (F = frequency, etc.). The instrument must be enabled at this time, or it will not allow the new value to be entered. Next, program the new value using numeric characters; the instrument must be enabled for these as well. Any sequence of characters (called the argument of the setting) which gives the new value is acceptable. For example, all of the sequences in table 3-5 will cause the value 100 to be programmed.

The numbers to the left of the "E" are the mantissa; the digit to the right (only one is allowed) is the exponent. The result value is the mantissa times 10 to the exponent power.

Table 3-3. Numeric Characters Used

ASCII Character	Keyboard Key	Function
0	0	Numeric digit
1	1	Numeric digit
2	2	Numeric digit
3	3	Numeric digit
4	4	Numeric digit
5	5	Numeric digit
6	6	Numeric digit
7	7	Numeric digit
8	8	Numeric digit
9	9	Numeric digit
.	.	Decimal point
–	+/–	Toggle sign
E	EXP	Indicates multiplication by 10 raised to a power

Table 3-4. Enabling Conditions

NOTE

An input source is enabled if all conditions in its row are true.

Input Source	Unit Selected*	Remote State Selected**	Keyboard Inhibited***
Keyboard	Yes	No	No
Wavetek Bus	Yes	No	Don't Care
GPIB	Yes	Yes	Don't Care

*Refer to paragraph 3.3.9.
**A GPIB function (refer to paragraph 3.6.1).
***A Wavetek bus function (refer to table 2-1).

Only one decimal point and one "E" (keyboard EXP) are allowed per number; additional ones are ignored. The sign toggle character may appear any number of times. It causes the sign of the mantissa (if "E" has not been programmed) or the exponent (if "E" has been programmed) to be reversed (if negative, then positive, and vice versa) each time it appears. Any number of nonprogramming characters may be interspersed with the numeric characters, as they have no effect. If an undesired value is entered, the CLR ENTY key can be used to erase it.

Several parameters require codes for specific selections; for example, the function codes of 0 thru 7 to select sine, triangle or square waves, etc. Refer to table 3-6 for parameter codes.

Table 3-5. Examples of Value Programming

ASCII	Keyboard	Std Notation
100	100	100
0100	0100	100 (leading zeros are ignored)
1E2	1 EXP 2	1×10^2
.01E4	.01 EXP 4	$.01 \times 10^4$
.01E34	.01 EXP 34	$.01 \times 10^4$ (last exponent digit only is used)
1000E-1	1000 EXP +/– 1	1000×10^{-1}
1E-2-	1 EXP +/– 2 +/–	1×10^2 (two minus signs cancel)
1E.2	1 EXP .2	1×10^2 (decimal points in exponent are ignored)

Since the number input format is so general, the microprocessor must be told when the last numeric character has been entered so it can evaluate the number. This is done by programming either an alphabetic, special, or terminator character. When this is done, the new value is first tested to see if it is a legal value for the setting being changed. If it is not legal, an error message is displayed on the front panel, and the setting value is not changed. If it is legal, the new

Table 3-6. Codes

Function (C) Codes	
Sine	0
Triangle	1
Square	2
DC	4
+ Pulse	6
– Pulse	7

Mode (B) Codes	
Continuous	0
Triggered	1
Gated	2
Synthesized (option)	3
Triggered Haverwave	4
Gated Haverwave	5
External Phase Lock	6

Output Load (P) Codes	
Load Out, Output On	0
Load In, Output On	1
Load Out, Output Off	2
Load In, Output Off	3

Symmetry (S) Codes	
50%	0, 5 or 50
10% - 90%	1 - 9 or 10 - 90

Unit (G) Codes	
Unit 1 selected (etc., thru 9)	1

Ampl Spec (V) Codes (Option)	
V p-p into 50Ω	0
Vrms	1
dBm	2

Talk (T) Codes (Option)	
Status	0
Error Status	1
Service Request Status	2
Current Equates	3
Value of Setting	4

value is entered into the instrument's memory; however, it is not sent to the analog circuits. That can be done only by programming the "I" action (EXEC key on the front panel). When a new value is entered into the instrument memory, it is rounded to the number of significant digits specified by the setting being changed, as specified by table 3-7. Review table 3-1 for examples of command structure.

Table 3-7. Round Offs

Letter	Setting Name	Number of Digits
A	Amplitude	3 if setting is less than 10; 4 if setting is greater than or equal to 10 *For example:* *1.5 (not rounded, has only 2 digits)* *1.853 (1.85)* *96.56E-1 (9.66)* *14.997 (15.00), illegal ampl*
O	Offset	3
F	Frequency	If synthesizer is installed: 5 if setting is less than 10 MHz 6 if setting is greater than or equal to 10 MHz If synthesizer option is not installed: 3 if setting is less than 10 MHz 4 if setting is greater than or equal to 10 MHz
S	Symmetry	1
All other settings		Nearest integer

3.3.1 Frequency

"F" followed by its argument denotes frequency in hertz. The argument value may be between 1.000×10^{-4} and 1.29999×10^{7}, fixed or floating. Refer to table 3-7 for round offs. In addition, the special argument value of zero is permitted. When this is programmed, the frequency magnitude is set to zero, but the range is left at its previously programmed value. This facility allows calibration and wide ranging sweeps.

3.3.2 Amplitude

3.3.2.1 All Waveforms

"A" followed by its argument denotes amplitude (in volts peak-to-peak into 50Ω on a standard 172A). The argument value may be between 1.00×10^{-3} and 1.499×10^{1}, fixed or floating. Round off is to 3 digits to 10V p-p and to 4 digits from 10 to 15V p-p. A minus sign in the mantissa will invert the waveform.

NOTE

When offset is used, three digit resolution of offset or amplitude may be reduced in some cases. (Refer to paragraph 3.3.3.)

3.3.2.2 Pulses

The positive and negative pulses are special cases of the offset square wave. The pulses are square waves that the microprocessor automatically offsets, so that the negative peak in + pulse mode and the positive peak in the — pulse mode are always at zero volts, regardless of the amplitude programmed. With this in mind, the rules and notation used in paragraphs 3.3.2.1 and 3.3.3 are applicable to the pulses.

3.3.3 Offset and DC Voltage

"D" followed by its argument denotes offset (or, with no waveform, dc voltage) value in volts. The argument may be between −7.49 and 7.49 and may be fixed or floating point. Round off is to 3 digits. The combined waveform and offset cannot exceed ±7.5V peak. As offset is increased, it is usually necessary to decrease the waveform peak-to-peak amplitude to stay within the peak limit; otherwise, waveform clipping will result.

The amplitude and offset are not completely independent of one another, because they share a common output amplifier and attenuator (see figure 3-2). In certain cases it may

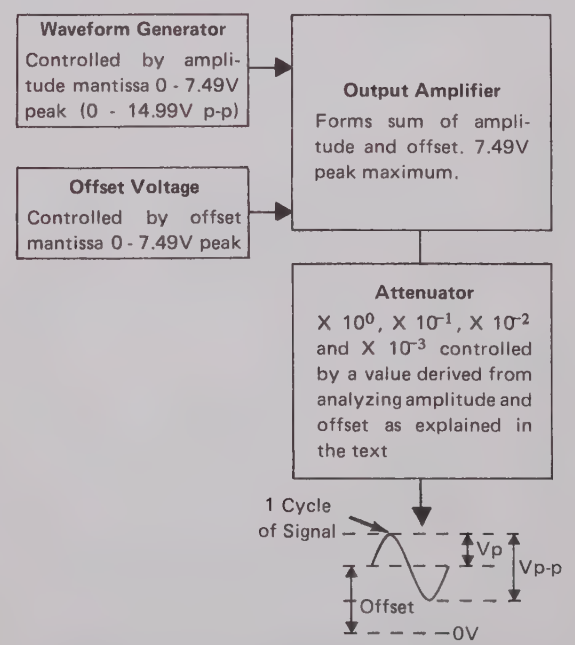

Waveform Generator
Controlled by amplitude mantissa 0 - 7.49V peak (0 - 14.99V p-p)
Offset Voltage
Controlled by offset mantissa 0 - 7.49V peak
Output Amplifier
Forms sum of amplitude and offset. 7.49V peak maximum.
Attenuator
X 10⁰, X 10⁻¹, X 10⁻² and X 10⁻³ controlled by a value derived from analyzing amplitude and offset as explained in the text
1 Cycle of Signal
Vp
Vp-p
Offset
0V

Figure 3-2. Hardware Diagram of Amplitude and Offset Generation

be necessary to decrease the number of digits of resolution of amplitude or offset in order to either prevent clipping in the output amplifier or to make the programmed value of offset (or amplitude) appear at the output despite an unfavorable attenuator setting necessitated by a larger value of amplitude (or offset).

The sum of amplitude and offset control the output amplifier and attenuator. The output amplifier is limited to ±7.5 volts peak and a 3 digit input (X.XX), and the attenuator can operate at only one value, X 10^0, X 10^{-1}, X 10^{-2} or X 10^{-3}.

If the *absolute peak value* at the amplifier is ever 7.50 or greater, logic decreases the amplifier input (amplitude + offset) by a factor of 10 and, to maintain the same value, decreases attenuation by a factor of 10 also.

To determine if there is clipping or loss of resolution, perform the following calculations.

1. Add the absolute value of the desired offset value to ½ the absolute value of the desired amplitude. If the sum exceeds 7.49, clipping will occur. If not, go on to step 2 to determine if loss of resolution will occur.

2. Write the larger of the absolute amplitude or absolute offset in the form N.NN X 10^x, where N.NN is between 1.00 and 9.99.

3. Take the sum of amplitude and offset computed in step 1 and write it in the form MM.MM X 10^x, where x is the exponent computed in step 2. If MM.MM is greater than 7.49, then one digit of resolution must be lost from both amplitude and offset in order to prevent the output amplifier from clipping.

4. Perform this step, if step 3 did not result in a loss of resolution. Write the amplitude or offset, whichever is smaller in absolute value, in the form YY.YYZZZ X 10^x, where x is the exponent computed in step 2. If any of the digits in ZZZ are nonzero, then resolution is lost, because only YY.YY can be used to program the waveform generator circuits.

Examples:

A. *Ampl = −3.43*
Offset = 4.25

Step 1. *4.25 + 1.72 = 5.97. There is no clipping.*

Step 2. *Abs offset is larger.*
4.25 = 4.25 X 10^0. Therefore, x = 0.

Step 3. *5.97 = 5.97 X 10^0. Therefore, there is no loss of resolution in either parameter.*

Step 4. *Abs amplitude is smaller.*
−3.43 = −3.43000 X 10^0. Therefore, there is no loss of resolution anywhere.

B. *Ampl = .0964*
Offset = .720

Step 1. *.720 + .0482 = .7682. There is no clipping.*

Step 2. *.720 = 7.20 X 10^{-1}. x = −1.*

Step 3. *.7682 = 7.682 X 10^{-1}. Since 7.682 exceeds 7.49, there will be a loss of one digit of resolution in both amplitude and offset. This means that the offset will be .720 and the amplitude will be .096 (not .0964).*

Step 4. *Not required.*

C. *Ampl = 2.58*
Offset = .123.

Step 1. *.123 + 1.29 = 1.413. There is no clipping.*

Step 2. *Abs amplitude is larger.*
2.58 = 2.58 X 10^0. Therefore, x = 0.

Step 3. *1.413 = 1.413 X 10^0. No loss of resolution so far.*

Step 4. *Abs offset is smaller.*
.123 = 0.12300 X 10^0. YY.YY = 00.12, ZZZ = 300. Therefore, one digit is lost in the offset, which will be .120, not .123.

3.3.4 Function

"C" followed by its argument denotes waveform selection. The argument may be one of the following. Round off is to nearest integer.

0 Selects sine wave

1 Selects triangle wave

2 Selects square wave

4 Selects dc voltage

6 + pulse

7 − pulse

3.3.5 Mode

"B" followed by its argument selects instrument mode. The argument may be 0 to 6. Round off is to one digit. The following modes are illustrated in figure 3-3.

0 Selects continuous. The generator runs continuously with parameters as programmed.

1 Selects triggered. The generator is quiescent until a negative going TTL pulse is fed to the TRIG IN BNC, the TRIG key is pressed, an ASCII "J" is programmed or a GPIB "GET" is programmed, which causes one cycle of the selected waveform to be generated.

2 Selects gated. The generator is quiescent until a negative going TTL pulse is fed to the TRIG IN BNC, which causes the generator to run for the duration of the pulse.

3 Selects synthesized (an option). The generator is phase locked to a frequency synthesizer for 5½ digit frequency resolution. (Refer to paragraph 1.2 for signal accuracy and purity.)

4 Selects triggered haverwave. As for triggered except the quiescent level is at the negative peak voltage (can be offset or inverted for desired level).

5 Selects gated haverwave. As for triggered haverwave except the generator runs continuously for the duration of the TTL level pulse fed to the TRIG IN BNC.

6 Selects external phase lock. When programmed within 2% of the TTL level 10 Hz to 13 MHz signal present at the ϕ LOCK IN BNC, the generator phase locks to that reference signal.

Figure 3-3 shows the waveforms and their phase relationship relative to the sync output and two controlling input signals: trigger and phase reference. The waveforms are sine, triangle and square plus their inverted forms. In the continuous mode, a trigger input has no effect, and in trigger and gated modes, phase reference input has no effect.

In triggered and gated modes, notice that square waveforms do not change state immediately upon being triggered. Trigger duration has no effect on triggered output, but does on gated output. The cycle count on the gated sine wave shows that when the gate signal ends in the shaded area, that is, between the positive peak of cycle 2 and positive peak of cycle 3, cycle 3 will be completed. In the haverwave modes, waveforms start at a peak value; all other waveforms are normally symmetrical about signal ground. Notice the symmetry control effects shown in one series of waveforms. Symmetry may be set at any multiple of 10% from 10 to 90%. Fifty percent is normal symmetry.

3.3.6 Load and Output

"P" followed by its argument selects the output and internal 50Ω load status. The argument may be 0 to 3. Round off is one digit.

0 Disconnects the internal load and connects the generator directly to the outside circuit.

1 Connects the internal load and connects the generator to the outside circuit.

2 Disconnects generator output and disconnects internal load.

3 Disconnects generator output and connects internal load to the outside circuit.

3.3.7 Symmetry

"S" followed by its argument controls the percent of on, or active, time of the total time for the selected signal. Symmetry operates on frequencies up to 999,990 Hz. Round off is to one digit.

The argument may be 0 to 9 or 10 to 90. Round off one digit. The effect of symmetry control is illustrated in figure 3-1.

0, 5 or 50 selects 50%

1 or 10 selects 10%

2 or 20 selects 20%

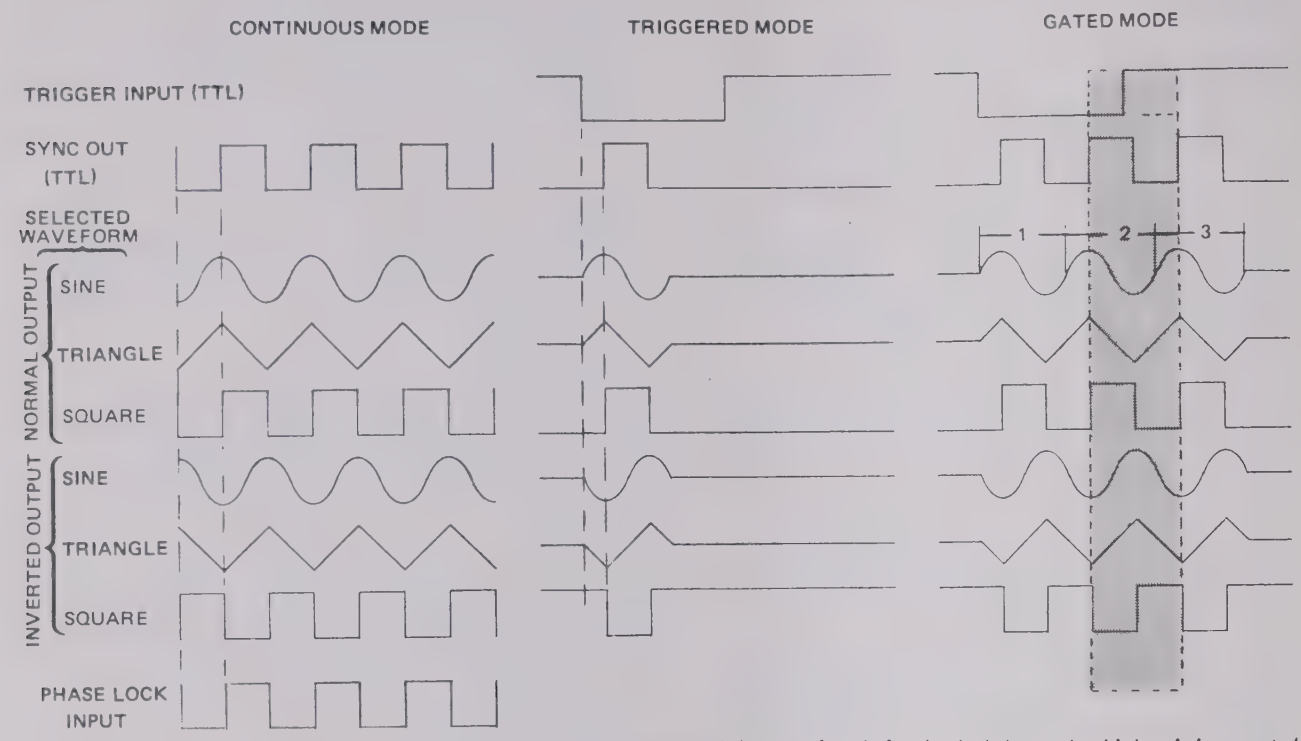
9 or 90 selects 90%

3.3.8 Executing the Program

"I" without an argument transfers the programmed values to the analog circuits; that is, executes the program. No waveform changes can be made unless this execute command is received. This function is also served by the GPIB Group Execute Trigger (GET) command.

3.3.9 Address

"G" followed by its argument selects the instrument with that unit address. The argument may be 0 to 9. Round off is to one digit. The Model 172A is equipped with a switch on the microprocessor board to set its address as 1 or 2, etc., up to 9. Those units that do not agree with the current address are deselected. If the address agrees, the unit will accept program input. Once a unit is addressed (for example, G2 of figure 2-1), all subsequent commands to G2 can be given without readdressing "G2" provided no other unit on the Wavetek ASCII bus is addressed between the commands for G2. However, if the GPIB option is being used, other



NOTE: If the gate signal rises any time during the shaded area, the third cycle is generated.

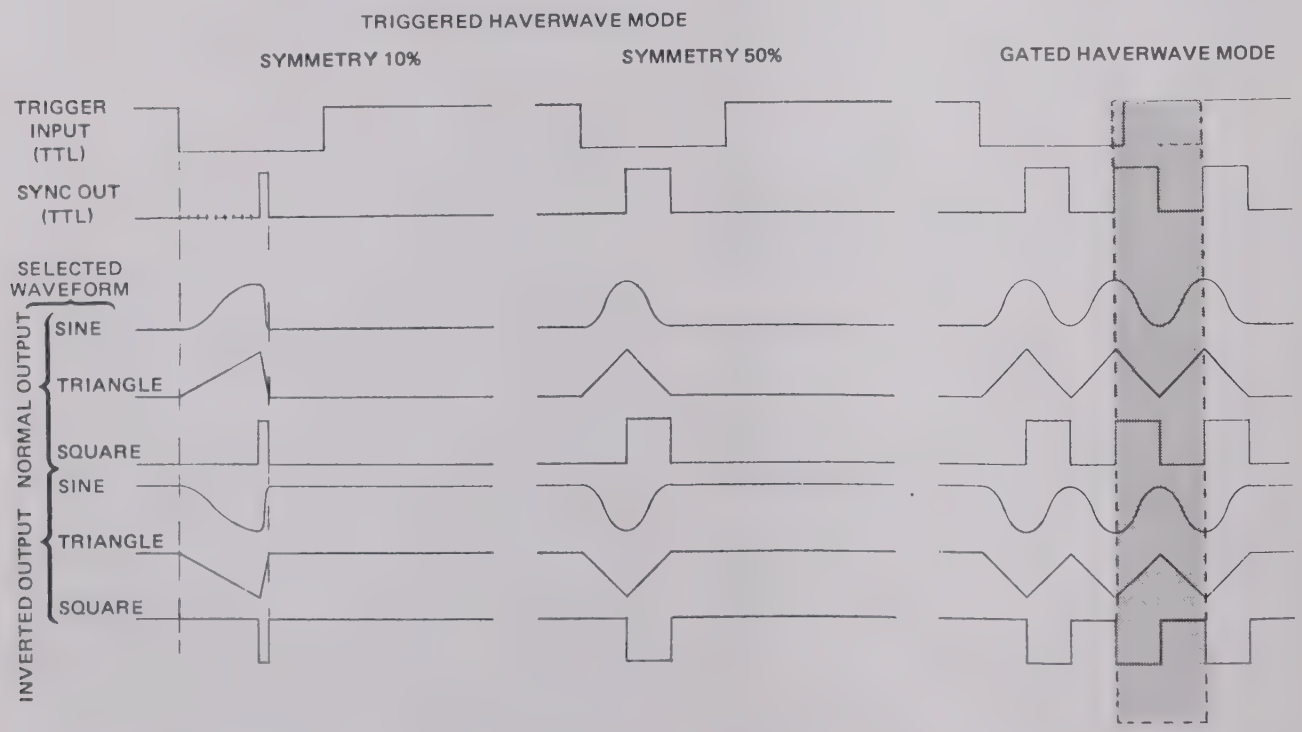


Figure 3-3. Waveforms for Each Mode

GPIB instruments (see figure 2-1) may be addressed between commands to G2 and it will not be necessary to readdress "G2" when commanding G2. Turning 172A power on causes it to be addressed.

3.3.10 Trigger

"J" without an argument causes a trigger pulse to be sent to the analog circuits when in trigger mode. This has the same effect as applying a trigger pulse to the TRIG BNC, pressing the keyboard TRIG or programming a GPIB "GET".

3.3.11 Amplitude Definition (an Option)

"V" followed by its argument selects the amplitude programming mode (for units with the Amplitude Output Conversion option). The argument may be 0 to 2. Round off is to one digit.

0 Selects volts peak-to-peak into 50Ω

1 Selects Vrms

2 Selects dBm

3.3.12 Command Recall

"R" without an argument will display the last 37 characters sent to the instrument. The display uses a 64 character subset of the full 128 character ASCII code: character codes 20_{16} thru $5F_{16}$. The other characters are displayed as the first set of 64; they are mapped into the first set by their six least significant digits. This function is used for troubleshooting. With the stored program option, this character has additional functions. See paragraph 3.7.2.

3.3.13 Equate

"=" followed by its argument is used to program an *equate*. An equate allows the programmer to change the correspondence between the alphabetic characters and the settings and actions that they designate to some other configuration than the power-on correspondence listed in table 3-2. The format for an equate is simply an equal sign followed by two alphabetic characters. An equate not in this format will be ignored. The first letter is the alphabetic character to be redefined. The second letter is the letter with which it is desired to select the setting or action of the first letter. For example, to cause the amplitude to be selected by the letter "Z", program = AZ. To then cause the amplitude to be selected by "N", program = AN. If two settings or actions are connected to the same letter, then the one whose corresponding letter in table 3-2 comes earlier in alphabetical order will be selected. For example, if = AZ = FZ is programmed, then when "Z" is programmed, amplitude will be selected instead of frequency, because A comes before F in the alphabet.

3.3.14 Errors

When a nonlegitimate argument is programmed, an error message is generated. Units with front panel option will display SETTING ERROR. Units with the GPIB option will request service from the controller (refer to paragraph 3.6). If an error occurs in a programmed setting, the previous value is retained.

3.4 OPERATING MODES

3.4.1 Initial Conditions

At power on, the instrument is set as follows: 1 kHz, 1V p-p, continuous, symmetrical sine wave with the output off and the internal 50Ω load not in the circuit.

3.4.2 Operating as a Basic Waveform Generator

When operating as a basic waveform generator, the generator runs continuously with parameters as programmed.

1. Make rear panel 50Ω OUT and SYNC OUT connections for signal and sync, as required.

2. Address the generator. (Refer to paragraphs 2.2.3 and 3.3.9.)

3. The output must be programmed on (P0 or P1). (Refer to paragraph 3.3.6.) The mode must be continuous (B0). (Refer to paragraph 3.3.5.)

4. Program the desired waveform, symmetry, frequency, amplitude and offset. (Refer to paragraphs 3.3.1 through 3.3.4 and 3.3.7.)

5. Execute the program. (Refer to paragraph 3.3.8.)

3.4.3 Operating as a Triggered or Gated Generator

See figure 3-3 for mode and waveform illustrations.

Triggered — The generator is quiescent until a negative going TTL pulse is fed to the TRIG IN BNC, the TRIG key is pressed or an ASCII "J" or GPIB "GET" is programmed, which causes one cycle of the selected waveform to be output.

Gated — As for triggered, except the generator runs continuously for the duration of the TTL level pulse fed to the TRIG IN BNC.

Triggered Haverwave	As for triggered except the quiescent level is at the negative peak voltage (can be offset or inverted for desired level).
Gated Haverwave	As for triggered haverwave except the generator runs continuously for the duration of the TTL level pulse fed to the TRIG IN BNC.

1. Make rear panel 50Ω OUT and SYNC OUT connections for signal and sync, as required.

2. Address the generator. (Refer to paragraphs 2.2.3 and 3.3.9.)

3. The output must be programmed on (P0 or P1). (Refer to paragraph 3.3.6.) The mode must be triggered (B1), triggered haverwave (B4), gated (B2) or gated haverwave (B5). (Refer to paragraph 3.3.5.)

4. Program the desired waveform, symmetry, frequency, amplitude and offset. (Refer to paragraphs 3.3.1 through 3.3.4 and 3.3.7.)

5. Execute the program. (Refer to paragraph 3.3.8.) The generator has no output until a trigger signal is applied.

6. If triggering with a TTL signal at the TRIG IN BNC or gating, apply a TTL low at the TRIG IN BNC for one cycle of waveform (triggered or triggered haverwave mode) or a burst of waveform for the duration of the TTL low (gated or gated haversine mode). If triggering at the front panel, press TRIG. If triggering on the Wavetek bus, program ASCII "J". If triggering on the GPIB bus, program an ASCII "J" or GPIB "GET".

3.4.4 Operating as a Voltage Controlled or Frequency Modulated Generator

VCG operation is the same as the basic waveform operation (refer to paragraph 3.4.2) plus the connection of a VCG voltage source to the VCG (FM) IN connector. Input impedance is 5 kΩ. Input is disabled when mode is synthesized or external phase lock.

The VCG input, either dc or ac, can be used to externally control the frequency of the 50Ω OUT signal. A positive voltage applied to the VCG IN connector will increase the generator frequency, and a negative voltage will decrease the frequency within the range of operation.

Figure 3-4 illustrates the voltage required to change the programmed frequency to a desired output frequency. For example, if 500 Hz is programmed frequency, a 2.5 volt VCG input will change the frequency to 1 kHz. Frequency can only be changed within a range (–3, –2, - - - - 6) and is limited in each range according to figure 3-5.

For wide range sweeping with a zero to a positive sweep voltage, use the special zero-frequency capability. Set $f_p = 0$ (F0I) to set a frequency under the lower defined limits of figure 3-5. The range remains as the last frequency range set.

3.4.5 Operating as a Frequency Synthesizer (an Option)

The generator with synthesizer option is phase locked to a frequency synthesizer for 5½ digit frequency resolution. (Refer to paragraph 1.2 for signal accuracy and purity.)

1. Make 50Ω OUT, SYNC OUT, REF IN and REF OUT connections for signal and sync, as required.

2. If an external 10 MHz reference is to be used, apply the signal to REF IN. (This signal is then available at REF OUT.) To use an external reference signal, apply a sine or square wave within ±3 ppm of 10.0 MHz, 1 to 10V rms and 50 ±8% duty cycle to the REF IN BNC.

3. Address the generator. (Refer to paragraphs 2.2.3 and 3.3.9.)

4. The output must be programmed on (P0 or P1). (Refer to paragraph 3.3.6.) The mode must be synthesized (B3). (Refer to paragraph 3.3.5.)

5. Program the desired waveform, symmetry, frequency, amplitude and offset. (Refer to paragraphs 3.3.1 through 3.3.4 and 3.3.7.)

6. Execute the program. (Refer to paragraph 3.3.8.)

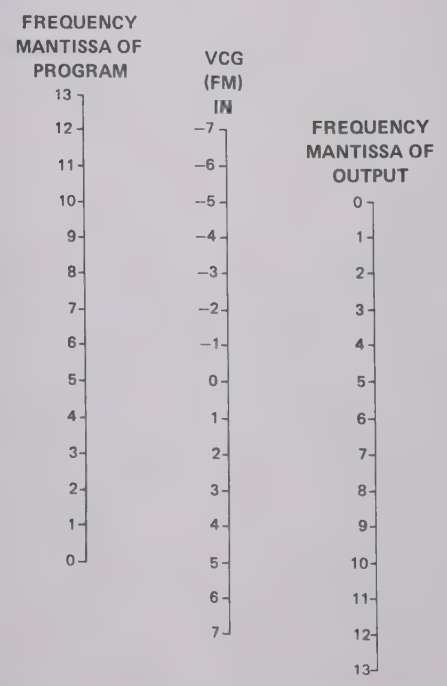
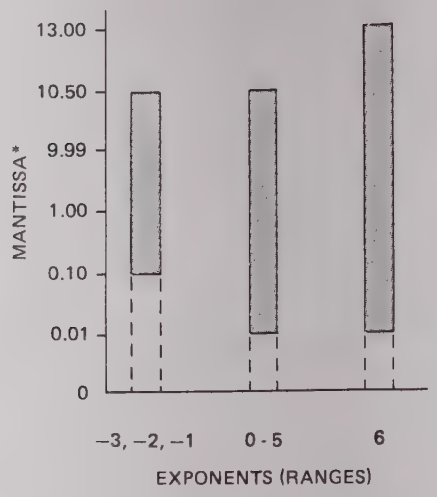


Figure 3-4. VCG (FM) Nomograph



*When program is stated with one digit to the left of the decimal (or two digits to the left of the decimal for values $\geqslant 10$ in the 10^6 range).

Figure 3-5. VCG Range Limits

3.4.6 Operating as a DC Voltage Source

DC voltage output amplitude is programmed as offset. Attenuation can be programmed directly in this mode.

1. Address the generator. (Refer to paragraphs 2.2.3 and 3.3.9.)

2. The output must be programmed on (P0 or P1). (Refer to paragraph 3.3.6.) The function must be DC (C4). (Refer to paragraph 3.3.4.)

3. Program offset for the desired dc amplitude. (Refer to paragraph 3.3.3.)

4. Execute the program. (Refer to paragraph 3.3.8.)

3.4.7 Operating as a Phase Lock Generator

When programmed within 2% of the TTL level 10 Hz to 13 MHz signal present at the ϕ LOCK IN BNC, the generator phase locks to that reference signal.

1. Address the generator. (Refer to paragraphs 2.2.3 and 3.3.9.)

2. The output must be programmed on (P0 or P1). (Refer to paragraph 3.3.6.) The mode must be external phase lock (B6). (Refer to paragraph 3.3.5.) Program the frequency to within 2% of the external reference frequency.

3. Program the desired waveform, symmetry, amplitude and offset. (Refer to paragraphs 3.3.1 through 3.3.4 and 3.3.7.)

4. Apply the 10 Hz to 13 MHz reference signal to the ϕ LOCK IN BNC.

5. Execute the program. (Refer to paragraph 3.3.8.)

3.5 FRONT PANEL OPTION

3.5.1 Keyboard and Display

Keyboard controls are listed in tables 3-2 and 3-3. Readout for the key functions are listed in table 3-8. Readout is literal and in two slightly different modes; for example, for frequency, amplitude and offset. When FREQ, AMPL or OFST keys are pressed, as for an inquiry as to status, the words MICROHERTZ, MILLIVOLTS, etc., are used, whereas when the operator starts keying in the parameter argument, no unit of measure is displayed. Coded parameters, such as symmetry, function, mode and output, show their programmed argument in parentheses.

3.5.2 Display

The single quote character (') is used to cause a string of characters to be displayed on the front panel self-scan display. This is accomplished by first programming a single quote, then the characters to be displayed, followed either by another single quote or by the terminator character. When the second quote or the terminator is programmed, the first 37 characters programmed after the first quote are displayed on the front panel. If fewer than 37 characters are programmed, then blanks are added to fill the display. Examples (∧ indicates a blank character):

Programmed Input

'THIS∧IS∧A∧29∧CHARACTER∧STRING'
'THIS∧STRING∧IS∧TOO∧LONG∧TO∧DISPLAY∧ENTIRELY'
'' (no character in string)

Actual Display

THIS∧IS∧A∧29∧CHARACTER∧STRING
THIS∧STRING∧IS∧TOO∧LONG∧TO∧DISPLAY∧EN
(blank display)

3.6 GPIB OPTION

The GPIB interface is an implementation of IEEE Standard 488-1975. It supports the following interface functions: Source Handshake (SH1), Acceptor Handshake (AH1), Talker (T6), Listener (L4), Service Request (SR1), Remote Local (RL2), Device Clear (DC1) and Device Trigger (DT1).

Table 3-8. Key and Readout

Key	Readout (lower case words added for understanding only)	Key	Readout (lower case words added for understanding only)
ADR	This UNIT is SELECTED (Unit No.) GPIB = (Decimal Address, ASCII listen character and ASCII talk character) or this UNIT is NOT SELECTED (Unit No. of some other unit; GPIB address of other unit)	SYM	___% SYMMETRY (0, 1, 2, - - - or 9)
		FUNC	FUNCTION IS SINE (0) or TRIANGLE (1) or SQUARE (2) or DC (4) or + PULSE (6) or –PULSE (7)
AMPL DEF	AMPLITUDE IN VOLTS PEAK-TO-PEAK or AMPLITUDE IN VRMS or AMPLITUDE IN DBM or nothing without Option 006	MODE	MODE IS CONTINUOUS (0) or TRIGGERED (1) or GATED (2) or SYNTHESIZED (3) or TRIGGERED HAVERWAVE (4) or GATED HAVERWAVE (5) or EXTERNAL PHASE LOCK (6)
CMD RCL	Lists last 37 characters programmed (refer to tables 3-2 and 3-3)		
		EXEC	F (freq) A (ampl) O (ofst)
OUTP	OUTPUT ON, 50 OHM LOAD OUT (0) or OUTPUT ON, 50 OHM LOAD IN (1) or OUTPUT OFF, 50 OHM LOAD OUT (2) or OUTPUT OFF, 50 OHM LOAD IN (3)	TRIG	172 TRIGGERED
		CLR ENTY	Clears any unexecuted setting of the last parameter entered
FREQ	FREQUENCY ____ MICROHERTZ or ____ MILLIHERTZ or ____ HERTZ or ____ KILOHERTZ or ____ MEGAHERTZ	SRQ	SRQ ENABLED or SRQ NOT ENABLED
		TLK	TALK RESPONSE (0, 1, 2, 3 or 4) selected
		TRM	TERMINATOR IS: (ASCII character) (decimal value)
AMPL	AMPLITUDE ____ MILLIVOLTS or ____ VOLTS		
		+/–	– or nothing, whichever it wasn't
OFST	OFFSET ____ MILLIVOLTS or ____ VOLTS		

NOTE: If the GPIB option is installed, the three right-most characters of the display will show the state of the GPIB interface.

Devices connected to the GPIB can have one or more of the three capabilities: talk, listen and control. The talk capability allows a device to send data (such as voltmeter or counter readings) out over the bus. The listen capability allows a device to receive data (such as device programming information or a printer receiving data to be printed) from the bus. The control capability allows a device to control the flow of data over the bus. Although there may be more than one device connected to the GPIB with control capability, only one device at a time may exercise that capability on the bus. One device's control capability must be active at all times; this device is called the controller.

Programming examples are given in Appendix C.

3.6.1 Bus Lines Defined

The GPIB consists of 16 signal lines, as shown in table 3-9. Their functions are:

DIO1 - DIO8 — These eight lines (Data In/Out) are used to send commands and data encoded as 8-bit binary numbers (bytes).

ATN — This line (Attention) is operated only by the controller. It specifies whether the information on lines DIO1 - DIO8 is data (false) or a command (true). Whenever ATN is set true, no activity is allowed on the bus except for controller-originated messages; additionally, every device connected to the bus is required to receive and process every command sent by the controller.

DAV, NRFD, NDAC — These are the "handshake" lines (Data Valid, Ready For Data and Data Accepted) which

Table 3-9. GPIB Lines and Commands

Bus Lines	
DIO1 - DIO8	Data In/Out Lines
ATN	Attention
DAV	Data Available
NRFD	Ready For Data
NDAC	Data Accepted
EOI	End Or Identify
REN	Remote Enable
SRQ	Service Request
IFC	Interface Clear

GPIB Commands	
Listen Address	
Talk Address	
Secondary Address	
Universal Commands	
DCL	Device Clear
SPE	Serial Poll Enable
SPD	Serial Poll Disable
Addressed Commands	
GTL	Go To Local
SDC	Selective Device Clear
GET	Group Executive Trigger

regulate the transmission of information over the lines DIO1 - DIO8. For each command or data byte transferred, a complete handshake cycle must occur. This handshake is designed to hold up the bus until the slowest device has accepted the information.

EOI — When ATN is false, this line (End Or Identify) indicates that the data on lines DIO1 - DIO8 is (true) or is not (false) the last byte of a data message. Refer to paragraph 3.6.6 for terminator character identification and figure 3-6 for mandatory use.

REN — This line (Remote Enable) is used to control whether devices on the GPIB are in local or remote mode. In local mode, devices respond to front panel commands and do not respond to GPIB-originated commands. In remote mode the situation is reversed: GPIB-originated commands are obeyed while front panel commands are ignored. A device enters the remote state whenever it receives its listen address (refer to paragraph 3.6.2, GPIB Commands) at the same time as REN is in the remote state. The device then stays in the remote mode until either the REN line is put in the local state or the device receives a Go-To-Local (GTL) command.

SRQ — This line (Service Request) is used by the devices on the bus to signal the controller that they need attention. (Refer to paragraph 3.6.5 for 172A Service Request Enable.) Since the SRQ line is common to all devices, additional tests must be made to determine which devices are signaling. The Serial Poll capability is usually employed to accomplish this.

IFC — This line (Interface Clear) is used by the controller to reset the interface logic in all devices connected to the bus to a known initial state.

3.6.2 GPIB Commands

Commands are sent over lines DIO1 - DIO8 with ATN true. They are divided into five classes.

3.6.2.1 Listen Addresses

Listen addresses are used to command a device to read any data bytes transmitted over lines DIO1 - DIO8. There are 31 different available addresses (hexadecimal codes 20 thru 3E, ASCII codes "SP" thru ">"). A thirty-second address, called unlisten (hexadecimal 3F, ASCII "?"), is used to command all devices not to read data bytes. The 172A's listen address is selected by the rear panel DIP switch, which specifies the lower 5 bits of the address. (Refer to table 2-3.)

3.6.2.2 Talk Addresses

Talk addresses are used to command a device to transmit data over lines DIO1 - DIO8 whenever ATN is false. There are 31 different available addresses (hexadecimal codes 40 thru 5E, ASCII codes "@" thru "↑"). A thirty-second address, called untalk (hexadecimal 5F, ASCII "→") is used to command all devices to cease talking. The lower 5 bits of the 172A's talk address are selected by the same rear panel DIP switch used to select the listen address. Thus, if the 172A's listen address is hexadecimal 21 (ASCII "!"), the talk address is hexadecimal 41 (ASCII "A").

3.6.2.3 Secondary Addresses

Secondary addresses are used following a talk or listen address to provide the ability to address more than the 31 devices provided for by simple talk or listen addresses. Secondary addresses are ignored by the 172A.

3.6.2.4 Universal Commands

Universal commands are used to command a device to perform designated actions. Universal commands are recognized at all times. Universal commands performed by the 172A are:

a. **Device Clear (DCL).** Resets the following settings to the power on state.

AMPLITUDE	1 VOLT
OFFSET	0 VOLTS
FREQUENCY	1 kHz
MODE	CONTINUOUS
FUNCTION	SINE
LOAD	OUTPUT OFF, LOAD OUT
SYMMETRY	50%

This information is also set into the waveform generating circuitry.

b. **Serial Poll Enable (SPE).** Causes the instrument to engage in a serial poll by responding with the serial poll status byte when addressed as a talker. Bit 6 of this byte will be on, if service is being requested on the SRQ line (in particular, the status byte will be an ASCII E, if service is being requested, zero, if not). When the status byte is read, it is reset to zero, and the SRQ line is released (of course, it may still be held down by other devices). The status byte is also available by reading the 172A's talk message number 2. When this message is read, the status byte is reset to 0 and SRQ released as for the serial poll.

c. **Serial Poll Disable (SPD).** Removes the instrument from the serial poll mode activated by the SPE command.

3.6.2.5 Addressed Commands

Address commands are used to command a device to perform designated actions. Addressed commands are recognized only when the instrument is addressed as a listener. Addressed commands performed by the 172A are:

a. **Go To Local (GTL).** Commands the 172A to go to the local mode (see explanation for REN line, paragraph 3.6.1).

b. **Selective Device Clear (SDC).** Same action as for Device Clear (DCL) command, paragraph 3.6.2.4.

c. **Group Execute Trigger (GET).** This command transfers the programmed waveform values to the waveform generation circuits, and then sends a trigger pulse. This is the same sequence of events that would happen if an EXECUTE, then a TRIGGER action were programmed. The trigger pulse has no effect unless the instrument is being set to a triggered or gated mode. If the instrument microprocessor is idle (i.e., not processing a previously sent programming string), this command is completed within a few milliseconds of being received; otherwise, it is not done until the program string is completely processed to ensure that up-to-date values are sent to the instrument circuits.

3.6.3 GPIB Data Transfers

The 172A will both accept programming characters and transmit status information over the bus. To program the instrument, first send the listen address (with ATN on), followed by the programming data (in ASCII, with ATN off). The instrument microprocessor accepts the data as fast as possible, until either 64 characters are received or there is a pause during the transfer of data. At that time, the entire string of received characters is scanned by the microprocessor, which carries out the programming instructions contained in it. While this is happening, the instrument can accept an additional 64 characters of data over the bus; if more are sent, the bus will hang until the microprocessor completes a scan and accepts the next 64 character string. Whenever the microprocessor finishes scanning a string, it puts a display on the front panel which reflects the state of input processing at that point. If the EOI line is asserted while sending a character to the 172A, the currently programmed terminator character will be put into the input string following the character with the EOI.

To read a message from the 172A, first send the talk address (with ATN on) over the bus. The instrument will then send the message currently selected by the Talk Message Select (T) setting. The last character of this message will be the currently programmed terminator character with the EOI line asserted.

3.6.4 Talker

"T" followed by its argument sets the particular type of status message sent by the 172A when asked to talk on the GPIB (see Appendix C). The argument may be 0 thru 4. Round off is to one digit. The argument code is:

0 Status message will give currently programmed waveform setting values. These will be the same as the values controlling the analog circuits if no new values were programmed since the last execute action. If this message is sent back to the 172A as programming input at a later time, it will restore the frequency, amplitude, offset, mode, function, output and symmetry settings to the values they had when the message was read from the 172A. (See figure 3-6.)

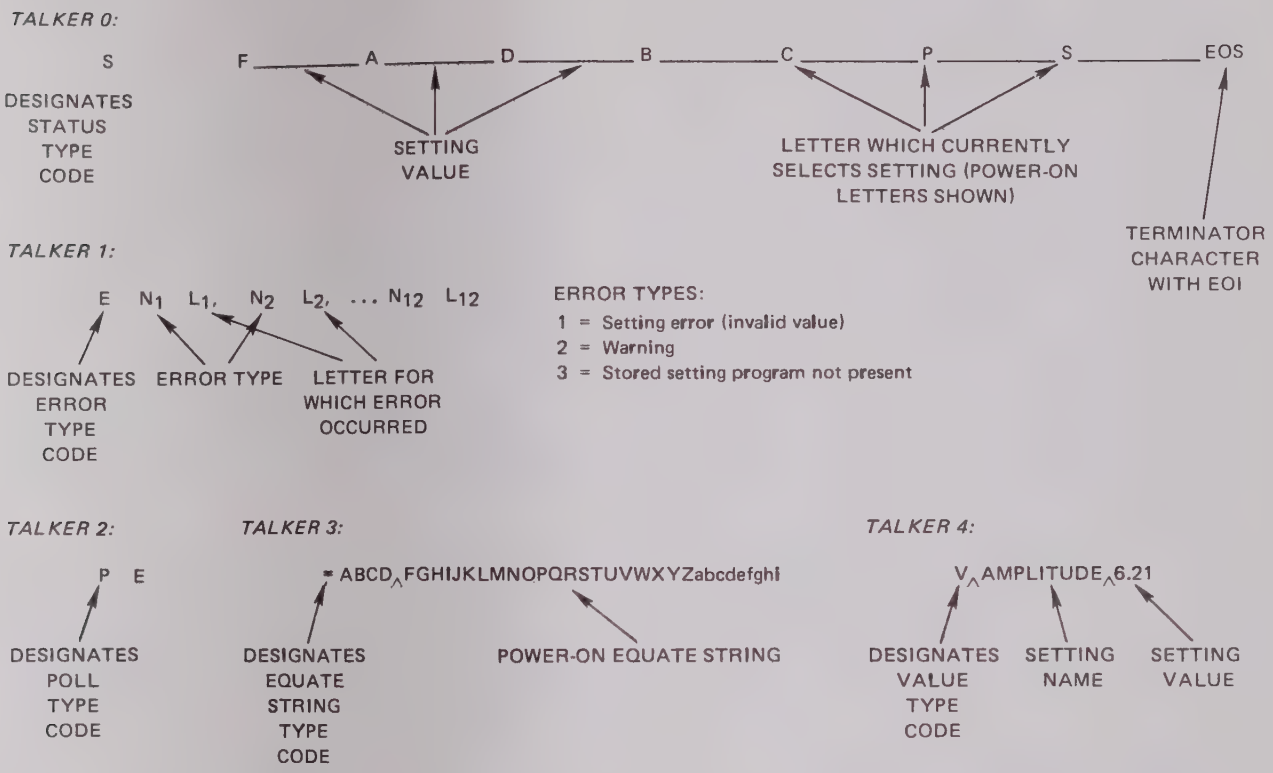


Figure 3-6. Status Formats

1 Status message will give a list of the first 12 errors since the last time this message was read from the instrument. After this message is read, the list of errors is cleared to blanks, so that a subsequent read will get only "E" until another error happens.

2 Status message contains the status byte which describes why the instrument is requesting service on the GPIB. It is the same byte which is read by a serial poll. Reading this message also turns off the service request if it was on. In the standard instrument, the only value defined for this byte is E for error.

3 Status message gives the current equate string. This is a string of characters that is used to select settings and actions. To match a letter with the setting or action that it controls, first find the left-most occurrence of the letter in the equate string. Then, starting from the left of the string, write the alphabet (A, B, C, etc., excluding E) under the equate string, one letter of the alphabet per letter of the equate string, skipping over blanks in the equate string. When the selected letter in the equate string is reached, then the alphabet letter under it, in conjunction with table 3-2, tells which setting or action is selected.

Example:

Suppose the equate string is ABWDFG. . . . To determine what setting "W" selects, first write the alphabet underneath, as follows.

ABWDFG . . .
ABC

Looking up "C" in table 3-2, we see that "W" will select "function".

4 Status message gives the current value (if any) of the setting selected by the last alphabetic character sent to the 172A. If that character selects an action or a nonexistent setting, the response is a blank character.

3.6.5 Service Request Enable

"Q" followed by its argument suppresses or enables service requests. The argument may be 0 or 1. Round off is to one digit. The argument code is:

0 Suppresses all service requests.

1 Enables all service requests.

3.6.6 End of String or Terminator Specification

"X" followed by its argument designates a new End Of String (EOS), or terminator, character. The argument is the decimal value of the ASCII character that is to be the new terminator: an EOS character recognized by the 172A. Any ASCII character is accepted.

The terminator character has two uses. During output, it is appended to the end of every response to a talk request on the GPIB. During input, it signals the end of a group of programming characters. Since it is always recognized, even in a quoted string or an equate, it can be used to insure that the instrument is in a known state, so that following programming characters will be interpreted correctly.

At power on time, the EOS character is the line feed control character, ASCII character (LF) 10_{10}. When the 172A issues a talk message, the EOS character is the last byte sent. In addition, the End Or Identify (EOI) line is pulled low (END message) during the EOS character transmission. If the GPIB controller does not look for the END message (EOI line low), and it does not recognize the Line Feed (LF) as a string terminator, a new EOS character will be needed. For example, to change the EOS character from an LF to a Carriage Return (CR), program an"X13" .

3.7 STORED PROGRAM OPTION

The Model 172A Stored Program Option allows the user to store in and recall from Random Access Memory (RAM) up to 100 different states of the instrument. Also, additional states may be recalled from Programmable Read Only Memory (PROM). The program settings stored in RAM are lost if instrument power is turned off, but program settings in PROM are permanent. Each program contains information specifying instrument frequency, amplitude, offset, mode, function, symmetry and load; all other instrument settings are unaffected by use of this option.

3.7.1 Storing Programs

Programs may be stored by keyboard or a command received over the GPIB or Wavetek bus interfaces. To store a program, first program the seven settings (frequency, amplitude, etc.) which are remembered in a program to the desired value, if not already programmed. Then press the STOR SET key or program the letter "M", followed by a number between 1 and 100, which identifies the particular program. The previous program with that number assigned, if there was one, is erased by the entry of the new settings. In any case, the current values of the frequency, amplitude, mode, function, symmetry and load settings are stored into the selected program.

3.7.2 Recalling Programs

The information stored in a program may be recovered either from the front panel or by a command over the GPIB or Wavetek bus interfaces. To recall from the front panel, press the RCL SET key, followed by the number of the desired program. When the next nonnumeric key is pressed, the seven settings stored in the selected program are transferred to the display memory and the analog scratch pad memory. This data is available to be sent to the analog circuitry of the instrument, or, if desired, it may be examined and possibly altered by use of the front panel keys. Recalling a program over the GPIB or Wavetek bus interfaces is a similar process. First, a "Y" character is programmed, followed by the number of the desired program. When the number is terminated, the program information is transferred to the display and analog scratch pad memories, as above. To preserve compatibility with previous models, the CMD RCL key (letter "R") also accesses stored programs, acting like the letter "Y".

The identifying numbers of programs in PROM range from 1000 through 1999, and those of programs in RAM range from 1 through 100. If the number of a program which does not exist or an illegal identifying number is programmed, an error will result. If a zero identifying number is programmed, the effect is the same as if a "W" was programmed (see the following).

Pressing the NEXT SET key or programming "W" causes the RAM program next in sequence after the last RAM program accessed to be recalled. This provides an automatic way to recall a sequence of programs. However, the programs need not be numbered consecutively. If there is no RAM program following the last RAM program accessed, an error occurs.

3.7.3 Recalling RAM Stored Settings for External Storage

To save existing RAM stored instrument settings, the settings stored at each RAM address must be recalled to the analog scratch pad memory and placed on the GPIB as a status talk message, where they may be recorded on magnetic tape or whatever.

Program a status talk message (T0). Program a recall of the first RAM stored settings (YX where X is 1 - - - - 100). Place the scratch pad memory contents on the GPIB by sending the 172A talk address with ATN on. Thereafter, program "W" to call up the next RAM stored settings. Continue the process until all settings are transmitted. (Refer to Appendix C, examples 3 and 4.)

3.7.4 Deleting Programs

To delete a program, program the letter "M" followed by a *minus* sign and the number of the program to be removed.

When the number is terminated, the program is removed from RAM storage; there is no other effect.

3.7.5 High Speed Recall

A special command letter, "Z", is provided to allow maximum speed program recall when used in place of the letter "Y" over the GPIB or Wavetek bus interfaces. This command operates exactly the same as the "Y" command previously described, except that when the selected program is recalled, the display memory is not updated, in order to save time. This means that if a program is recalled with the "Z" command and the instrument settings are examined using the front panel keys, the values displayed will be those in effect before the program was recalled. Nevertheless, the correct, new values will be sent to the instrument analog circuits when the EXECUTE command (I) is given or a GET is done on the GPIB interface. For example, assume that AMPL 1 EXEC has been programmed on the front panel, and that program 10 has an amplitude setting of 2 volts. Then, if "Z10I" is programmed over the GPIB or Wavetek bus interfaces, the analog circuits will be set to output an amplitude of 2 volts, but if the amplitude setting value is interrogated by pressing the AMPL key, a value of 1 volt will be displayed.

Table 3-10 gives an example of the usage of the storing, recalling and deleting functions of the Stored Program option over the GPIB interface. The sequence of commands listed is optimized for maximum speed. The following actions are performed. First, five programs are created which generate a one volt sine wave at the five frequencies 1 Hz, 10 Hz, 100 Hz, 1 kHz and 10 kHz. Next, these five programs are recalled and executed in sequence. Then, program number 13 is deleted and the four remaining programs are again recalled and executed in sequence.

Table 3-10. Example of Using Stored Programs

Command String	Comments
A1D0B0C0P1S0	Initialize settings to provide a one volt continuous sine wave. These settings will be the same for all five programs.
F1M11 F10M12 F100M13 F1E3M14 F10E3M15	Set frequency to 1 Hz and store settings in program 11. Continue with 10 Hz, 100 Hz, 1 kHz and 10 kHz, storing into programs 12 - 15. Note that each program contains the values of all the seven settings (amplitude, frequency, offset, mode, function, symmetry and load), even though in this example only the frequency is being varied.
Z11 [terminator] *	Prepare to sequence through the programs by recalling program 11, using the "Z" form for highest speed. The [terminator] is necessary to terminate the number and cause the recall action to occur.
[GET] ** Z0 [terminator]	Use the GPIB group execute trigger command to execute the program, and then, while the waveform selected by program 11 is being used, command the instrument to recall the next program (number 12). With this method, the activity of accessing program 12 is occurring simultaneously with the use of the waveform specified by program 11. At this point, the instrument is outputting a 1 Hz sine wave.
[GET] Z0 [terminator]	Cause the instrument analog circuits to be set to the state selected by program 12, and then fetch program 13. Instrument output is 10 Hz.
[GET] Z0 [terminator]	Execute program 13 and fetch program 14. Instrument output is 100 Hz.
[GET] Z0 [terminator]	Execute program 14 and fetch program 15. Instrument output is 1 kHz.
[GET]	Execute program 15. Instrument output is 10 kHz.
M-13	Delete program 13 from RAM storage.
Z11 [terminator]	Again start at program 11 and sequence through the programs. Note in the following that when program 12 is accessed, program 14 is accessed next.

Table 3-10. Example of Using Stored Programs (Continued)

Command String	Comments
[GET] Z0 [terminator]	Execute program 11. Output is 1 Hz.
[GET] Z0 [terminator]	Execute program 12. Output is 10 Hz.
[GET] Z0 [terminator]	Execute program 14. Output is 1 kHz.
[GET]	Execute program 15. Output is 10 kHz.

*[terminator] is either an alphabetic character A through Z (excluding E), the currently selected terminator character (which is line feed when the instrument is powered on), or the EOI signal asserted in conjunction with the last character of the string.

**[GET] is the GPIB group execute trigger command.

SECTION 4
CIRCUIT DESCRIPTION

4.1 INTRODUCTION

The major components of the Model 172A are shown in figures 4-1, 4-2 and 4-3. The blocks in figure 4-3 correspond to actual assemblies. Each circuit board is shown as a block diagram in subsequent figures.

The analog portion of the 172A consists of a function generator (VCG, Triangle Generator and Function/Preamp boards), output amplifier with offset and attenuator (Attenuation board) and an optional frequency synthesizer (1st Digit/Mixer, 2nd and 3rd Digit and 4th and 5th Digit/Reference boards). The synthesizer is controlled by logic to produce some multiple of the desired output frequency; its output is within the 1 to 13 MHz range. In synthesizer mode, this frequency is divided down to the desired frequency, by logic control, at the function generator. The function generator is then phase locked to it. In function generator mode, the frequency may be controlled by VCG voltage as well as logic, and, in external phase lock mode, phase lock occurs when the 172A frequency remains within 2% of the external signal frequency.

The digital portion of the 172A consists of the bus and front panel inputs to the microprocessor (Microprocessor, Memory RAM and Memory PROM boards) and its output to the analog portion of the 172A. The optional GPIB input is interfaced to the microprocessor by the GPIB board. The microprocessor also controls the front panel readout and sends status and error messages on the GPIB.

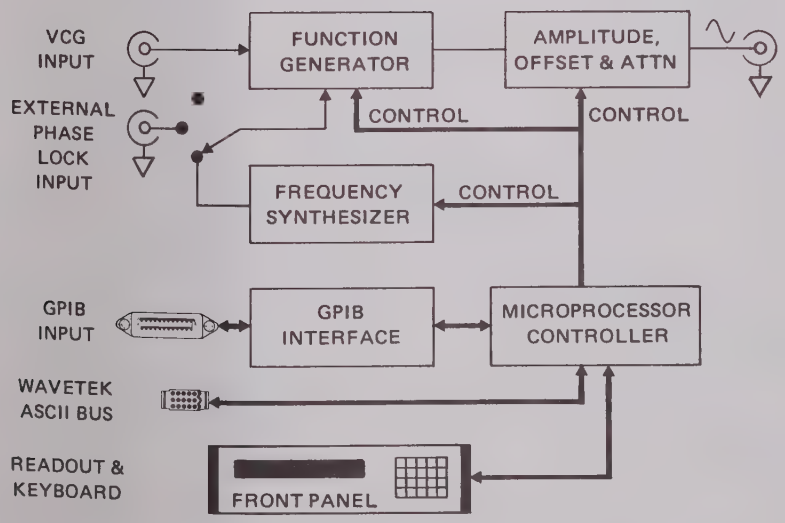
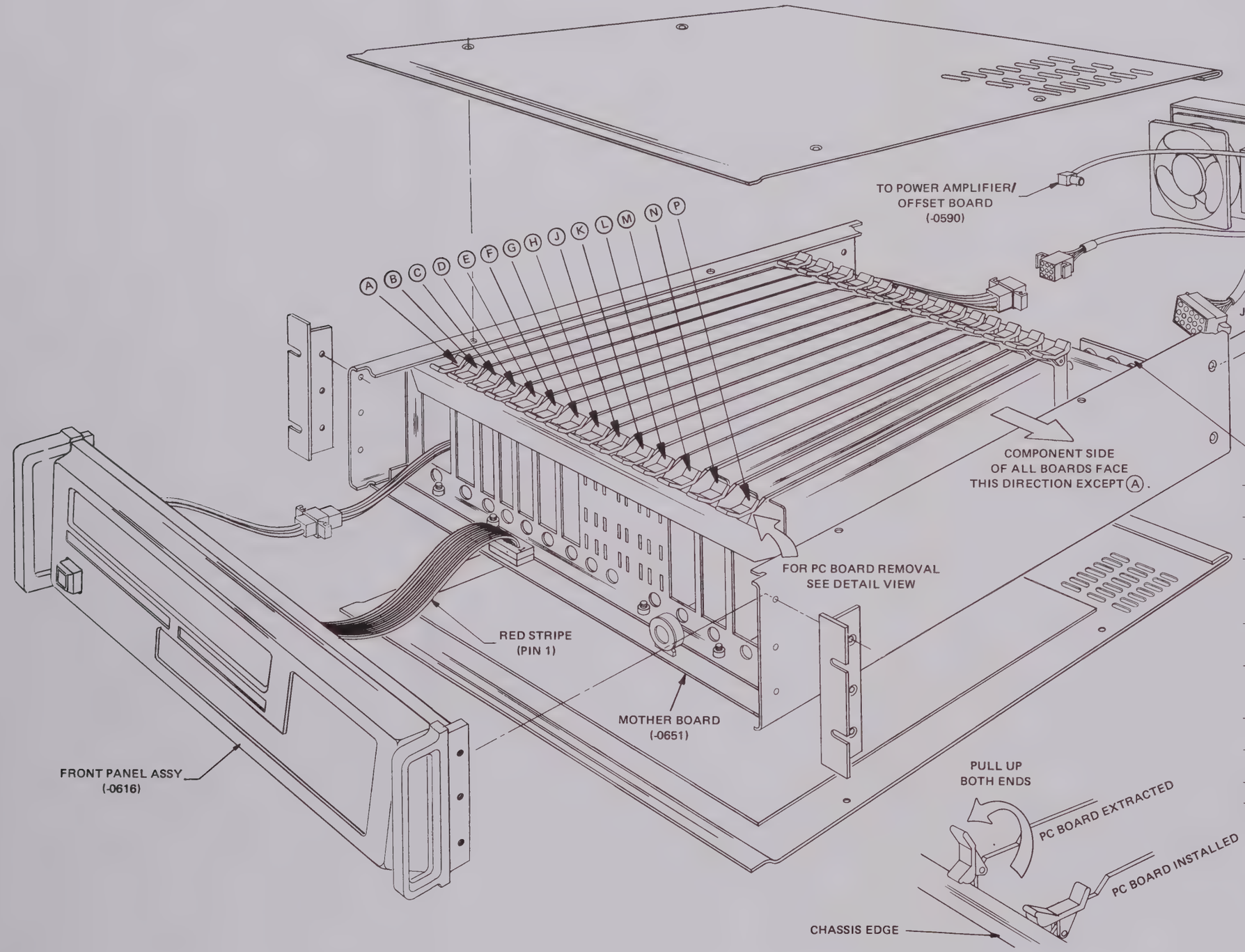


Figure 4-1. Overall Block Diagram



PCA Key	Assembly No.	Board Ejector Color	Assembly	Group
A	-0634	Black	Pass Transistor/Regulator	Power Supply
B	-0633	Black	Power Supply Regulator	
NA	-0614	NA	Rear Panel (Transformer, Capacitors, etc.)	
L	-0612	Yellow	VCG and Symmetry	Function Generator (function generator calibration usually required when any function generator board is replaced)
K	-0635	Green	Triangle Generator	
J	-0490	Blue	Function/Preamp	
G	-0590	Gray	Power Amplifier/DC Offset	
H	-0638	Violet	Three Digit Attenuator	
M	-0509	Orange	Digit 1/Mixer	Synthesizer (Option 002)
N	-0500	Red	Digits 2 and 3	
P	-0501	Brown	Digits 4 and 5/Reference	
E	-0647	White	Mircroprocessor (With Wavetek Bus Address Switch)	Microprocessor
D	-0493	White	Memory RAM	
C	-0494	White	Memory PROM (May Have: Stored Setting Option 003; Ampl Conversion Option 006)	
F	-0643	White	GPIB Interface	GPIB Interface (Option 005)
NA	-0554	NA	GPIB Decoder	
F	-0491	White	154/157 Emulator Interface	154/157 Emulator (Option 004)
NA	-0505	NA	Emulator Decoder	
NA	-0616	NA	Front Panel	Front Panel (Option 001)

dual ext. 1100-00-0799 [illegible] 179.58

Figure 4-2. Circuit Board Location

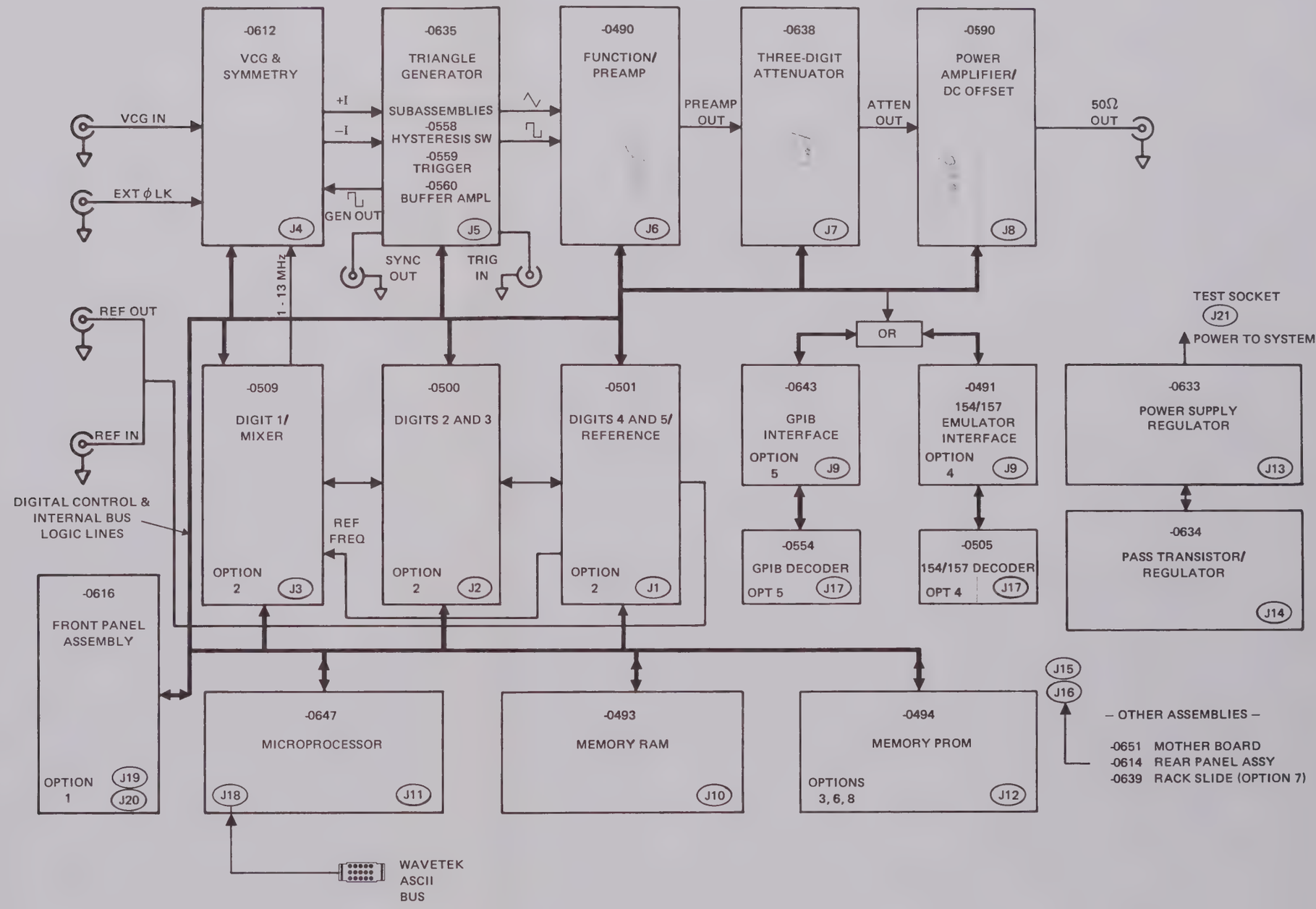


Figure 4-3. Board Interconnection Block Diagram

4.2 VCG AND SYMMETRY (-0612)

The purpose of the -0612 VCG and Symmetry board (figures 4-3 and 4-4) is to provide positive and negative currents to the Triangle Generator board that are proportional in amplitude to the desired three digits of frequency; and then proportional, positive current to negative current, according to the desired waveform symmetry.

The input to the VCG and Symmetry board is internal bus logic, VCG (Voltage Controlled Generator) voltage from the VCG (FM) BNC and the synthesizer signal which may be from 1 to 13 MHz, which is some power of ten multiple of the programmed frequency. The logic is controlled by programmed mode, frequency range and the three-digit frequency value.

The frequency of the generator is determined by the rate of charge and discharge of the "range" capacitance on the Triangle Generator board (figure 4-5) by the positive and negative currents. The entire range of frequencies from 0.1 mHz to 13 MHz is achieved by selecting a capacitance, then varying the current from low to high. When near maximum current is reached, a smaller capacitance is selected and the current increased from low to high again. Each set of capacitance determines a frequency range. This scheme is used until 1 MHz is reached. From 1 through 13 MHz, an additional boost in current is used in lieu of a change in capacitance.(Symmetry control is inhibited on this range.) This boost is logic controlled (figure 4-4), as is switching in individual alignment resistors for each range. See frequency range blocks on the diagram. Internal bus control logic from the microprocessor also selects three digits of frequency within a range and determines whether or not external voltage (VCG) will be allowed to share in the control of the frequency of the generator. If in synthesizer or phase lock mode, VCG is not allowed. The input VCG voltage, if allowed, is combined with the other voltages at the digital to analog amplifier to drive the current generators.

Programming the symmetry selects the resistances which control the balance between the positive and negative current generators.

In phase lock or synthesizer mode, the analog voltage that controls the current generators is supplemented with the error voltage required to maintain phase lock with an external signal or phase lock with the synthesizer circuits. This error voltage is generated by phase detecting the difference between the square wave from the triangle generator hysteresis switch and the external signal or the synthesizer signal, whichever was selected by mode logic. The generator square wave will be in phase with the external input and the sine wave 90° out of phase when external phase lock is selected. The external signal and the generator signal must be within 2% of frequency for phase lock to occur. The compared synthesizer frequency is always within 2% of the generator frequency. The synthesizer itself has a range of only 1 to 12.999 MHz; hence, the divide by N circuit prior to the phase detector.

If the generator frequency is in the 10^6 range, no division is required; however, for each lower range a division must occur prior to phase detection and phase locking of the generator to the synthesizer:

Range	N
10^6	1
10^5	10^1
10^4	10^2
etc.	

4.3 TRIANGLE GENERATOR BOARD (-0635)

The purpose of the -0635 Triangle Generator board (figures 4-3 and 4-5) is to produce both the triangle and square waveforms at the frequency determined by the currents from the VCG and Symmetry board. The generator will free run or will turn on and off in response to a trigger or gate voltage, depending on the mode selected.

Input to the board is trigger voltage applied at the TRIG IN BNC, internal bus control logic and positive and negative currents proportional to the programmed frequency and symmetry from the VCG and Symmetry board. Output is the triangle and square waveforms to the Function/Preamp board and a sync signal based on the square wave to the SYNC OUT BNC. Triggered output starts at the normal 0° waveform phase or, when in haverwave modes, −90° phase.

The diode switch, which is controlled by the hysteresis switch, is used to switch the positive or negative current to the timing capacitor selected by the frequency range logic. When the positive current is switched into the timing capacitor, the voltage across the capacitor will rise linearly to generate the triangle rise transition. When the current is negative, the voltage across the timing capacitor will fall linearly to produce the fall transition of the triangle.

The triangle amplifier output is fed to the hysteresis switch and to the $\wedge\vee$ buffer amplifier. The $\wedge\vee$ buffer is fed to the Function/Preamp board (figure 4-6). The hysteresis switch has two voltage limit points (+1.25 and −1.25) at its input.

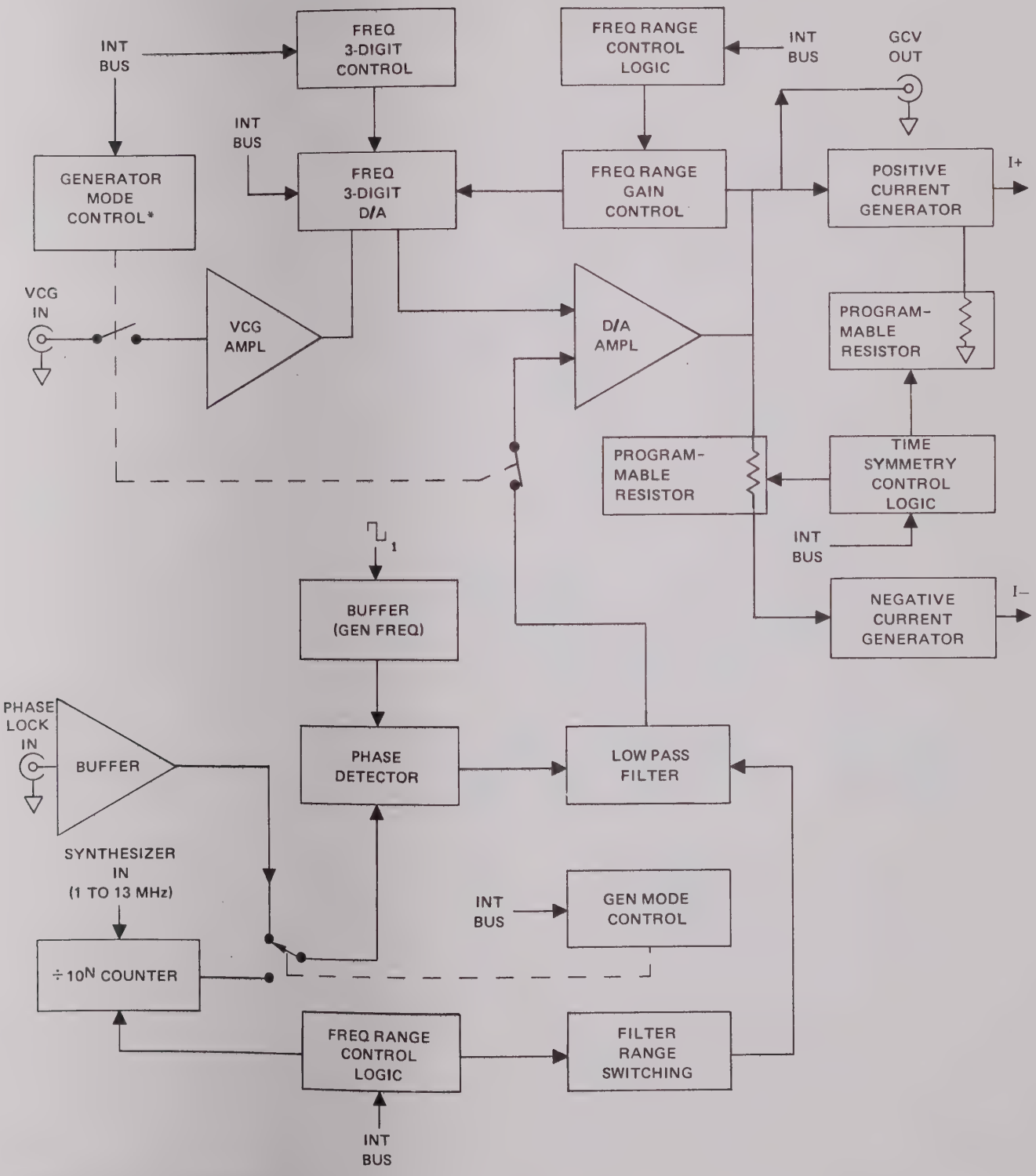


Figure 4-4. VCG and Symmetry (-0612) Block Diagram

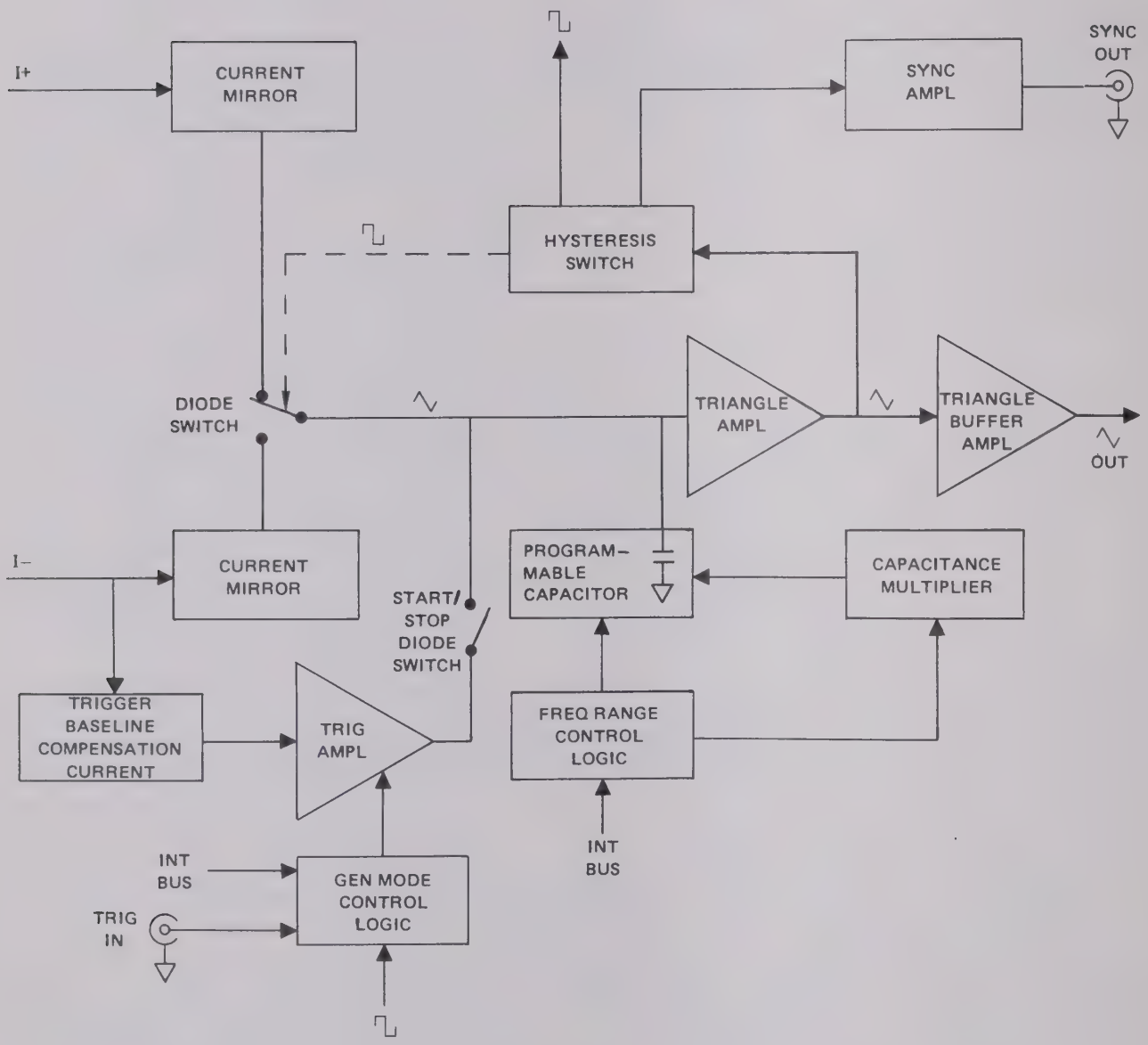


Figure 4-5. Triangle Generator (-0635) Block Diagram

During the time the output voltage of the triangle amplifier is rising, the output voltage of the hysteresis switch is positive, but when the output voltage of the triangle amplifier reaches +1.25V, it triggers the hysteresis switch, causing the hysteresis switch output to switch negative. Once the control voltage into the diode gate becomes negative, it switches the positive current out and the negative current in to the timing capacitor, so that the direction in the voltage change across the capacitor reverses, starting a linear decrease of the waveform. When the decreasing voltage reaches −1.25V, the hysteresis switch output switches back to positive, reversing the process. This action generates the triangle waveform. Since the hysteresis switch output is a square wave, the result is simultaneous generation of a square wave and a triangle wave at the same frequency.

The frequency is range controlled by selecting various capacitance and finely controlled by the charging currents. Symmetry of the waveforms is controlled by the degree of imbalance between positive and negative currents. To avoid the use of very large capacitors for the low frequency ranges, a capacitance multiplier circuit simulates a larger capacitor by a proportional decrease in charging current.

The enabling of generator operation is controlled by allowing or preventing the selected timing capacitor to charge. For continuous operation, the trigger amplifier maintains a positive level above the positive peak developed by the charging capacitors. This reverse biases (turns off) the start/stop diode switch, preventing the trigger amplifier from affecting continuous operation.

When in trigger mode, the trigger amplifier outputs some level below the positive peak charging level, the diode switch is forward biased (turned on) holding the charging level constant and preventing the capacitor from charging to the positive peak. This stops operation and holds the output at a dc level called the trigger baseline, the level from which a waveform cycle starts and where it will stop. Normally, this is midway between the peaks. In the haverwave mode and for square and pulse functions, it is at the negative peak level.

When the charging level is being held, the negative current generator still varies its output with corresponding frequency control inputs. These varying currents must be taken up through the diode switch to keep the timing capacitors from varying their charge, and thus the trigger baseline. The baseline compensation circuit monitors the output from the negative current generator to control the trigger amplifier, and thus the necessary compensating current through the diode switch.

The generator mode control circuit determines whether the trigger control logic is to be "fired" for just one cycle, or is to be held on for the duration of the trigger input during gated mode or is to be hold on continuously during continuous mode. When in gated mode, the trigger signal is directly coupled for controlling the trigger control logic. In the trigger mode, the trigger signal is capacitively coupled to provide a leading edge spike to "fire" the trigger control logic. The trigger control logic determines that after a waveform starts, it always stops at a complete cycle at the same phase at which it started. The trigger control logic latches the trigger amplifier for an enabling output from the time the cycle starts to when the negative peak of the last cycle is reached (just one cycle in the trigger mode). Upon reaching the negative peak, the timing capacitor wants to continue charging positive again as usual, but stops upon reaching the trigger baseline. A square wave from the hysteresis switch synchronizes the last negative peak time for unlatching the trigger amplifier.

4.4 FUNCTION/PREAMP (-0490)

The -0490 Function/Preamp board (figures 4-3 and 4-6) creates a sine waveform and selects the output function as one of the following:

Sine wave
Triangle wave
Square wave
Inverted (with respect to sync) sine wave
Inverted (with respect to sync) triangle wave
Inverted (with respect to sync) square wave
No signal

The input to the Function/Preamp board is the buffered triangle wave and square waveform from the Triangle Generator board and the internal bus logic. Output is the selected function or dc, which goes to the Three-Digit Attenuator board (figure 4-7).

The triangle wave is processed by nonlinear diode networks to produce a sine wave, and the square wave is precisely clipped. All three waveforms, triangle, sine and square, are present for function selection by logic. The selected waveform, or no waveform, is amplified and presented in both normal and inverted form for final logic selection.

4.5 THREE-DIGIT ATTENUATOR (-0638)

The -0638 Three-Digit Attenuator board (figures 4-3 and 4-7) accurately controls the amplitude of the output signals from the Function/Preamp board and within the particular range setting.

The input is the internal bus logic and the signal selected by the Function/Preamp board. The output is the attenuated signal sent to the Power Amplifier/DC Offset board. The logic sets the attenuation network to accurately produce an amplitude expressed as X.XX.

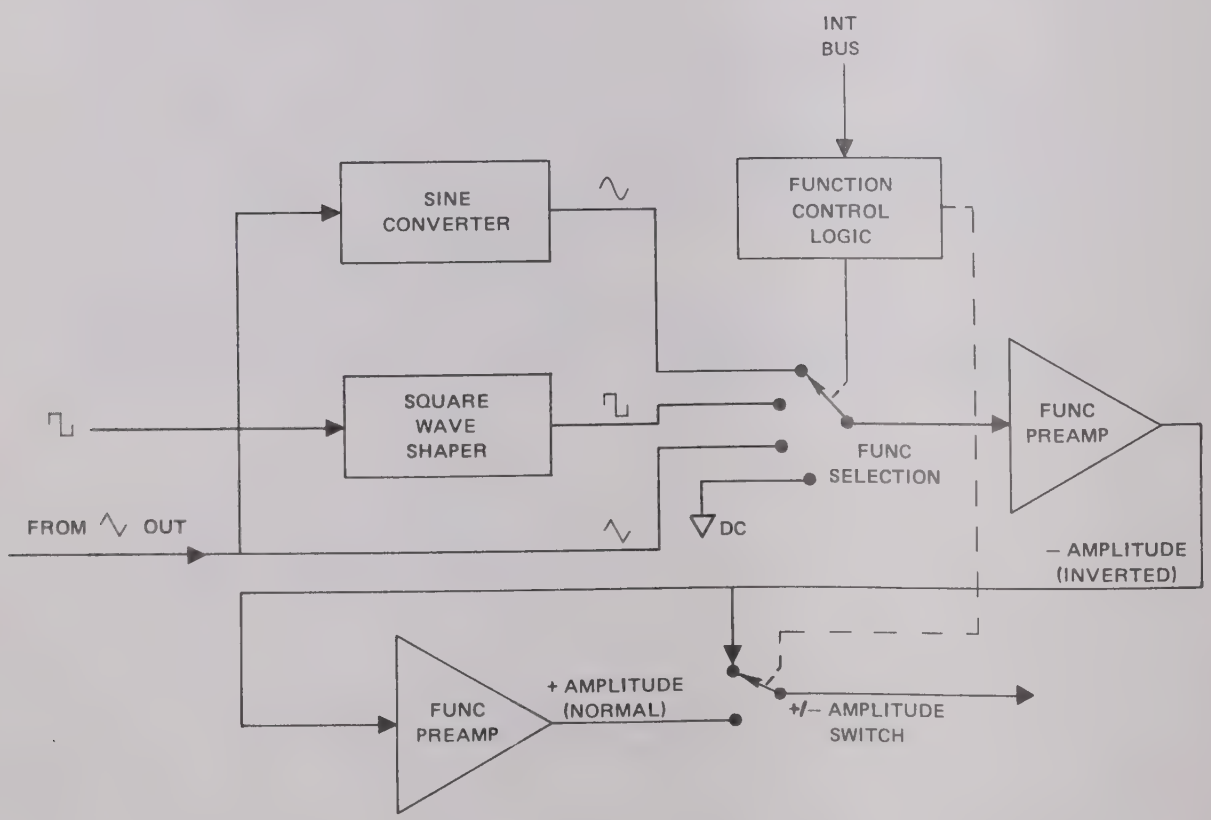


Figure 4-6. Function/Preamp (-0490) Block Diagram

4.6 POWER AMPLIFIER/DC OFFSET (-0590)

As controlled by logic, the -0590 Power Amplifier/DC Offset board (figures 4-3 and 4-7) amplifies the three-digit attenuated signal by the amount corresponding to the amplitude range value; dc offsets the signal, connects or disconnects the signal from the output BNC and connects or disconnects an internal load termination. The input to the board is the three-digit accurate signal (X.XX) from the Three-Digit Attenuator board and internal bus logic. The output is the finally processed signal to the output BNC connector.

The three-digit signal is amplified and offset (if required) at the power amplifier circuit. The three-digit value of offset (X.XX) is logic controlled as is the positive or negative direction of offset. The sum of offset and signal amplitude is amplified to 15 volts peak (30V p-p), then attenuated to the logic controlled range value. The range value is logic selected to be the greater of amplitude or offset programmed range. The output signal is then output and loaded according to control logic.

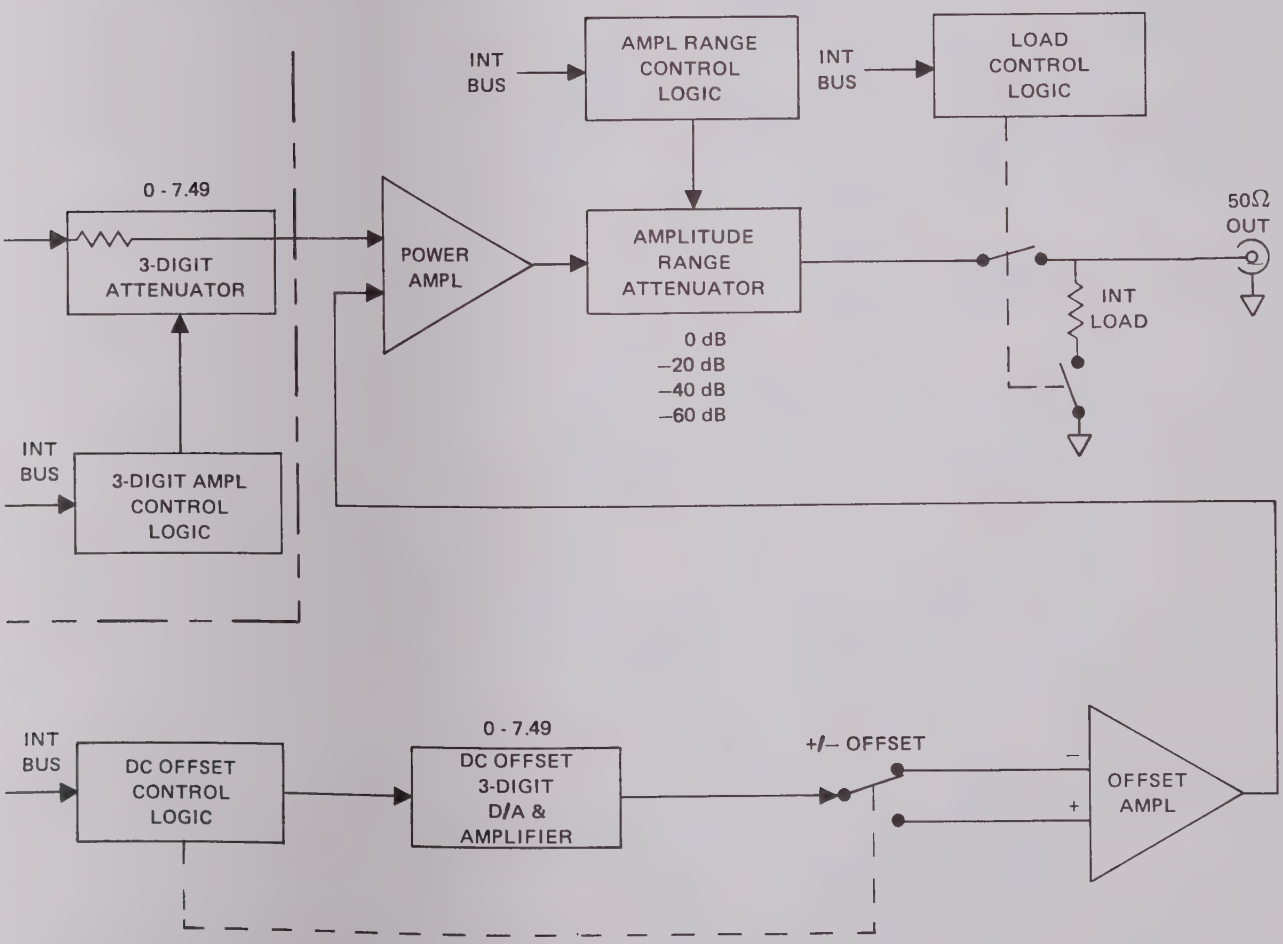


Figure 4-7. Three-Digit Attenuator (-0638) and Power Amplifier/DC Offset (-0590) Block Diagram

4.7 SYNTHESIZER (-0500, -0501, -0509; an Option)

The synthesizer (figure 4-3: Digit 1/Mixer, Digits 2 and 3, Digits 4 and 5/Reference boards) provides 1 to 12.999 MHz with five-digit accuracy. The function generator circuit is phase locked to multiples of the synthesizer output for waveform functions with five-digit frequency accuracy. Four phase locked loops (PLL's) are connected together along with a mixing system and a reference section of the required fixed frequencies to make up the synthesizer. These sections are packaged as -0509 Digit 1/Mixer board, -0500 Digits 2 and 3 board and -0501 Digits 4 and 5/Reference board.

Figure 4-8 is the block diagram of a simple PLL. The output frequency is to be exactly some multiple of the reference frequency (f_r). The output frequency of the voltage controlled Variable Frequency Oscillator (VCO) is divided by a digital counter circuit. The output frequency of the divide by N(÷N) is compared with the reference frequency (f_r) by a frequency phase detector. If the frequency and/or phase of the two signals differ, an error voltage is generated which causes the VCO to change its frequency, moving in the proper direction to correct for the error. There is an integrator/Low Pass Filter (LPF) between the phase detector output and the VCO to eliminate high frequencies out of the detector and to insure loop stability. The output frequency is the reference frequency multiplied by the ÷N ratio.

Figure 4-9 is a block diagram of the digit 1 PLL of the five-digit synthesizer. The output of this loop goes from 35 to 47 MHz, as the most significant digit of the synthesizer output frequency is varied from 0 to 12 MHz. This block diagram is different from figure 4-8 in that there is a fixed ÷2 ahead of the programmable divider. This makes the total ÷N ratio twice that of the programmable divider alone. If the total synthesizer output is required to be 10,000 MHz, then the digit 1 loop output will be 45 MHz. The number 10 will be loaded into the programmable divider in Binary Coded Decimal (BCD) form by the logic interface portion of the 172A. The programmable divider translates this number 10 into the divider ratio 45 with a PROM loop-up table. The programmable divider ratio 45, together with the fixed divide by 2, gives a total ÷N of 90. The 500 kHz reference frequency multiplied by 90 gives an output frequency of 45 MHz. The programmable divider alone, and a 1 MHz reference frequency, would give the same results; the ÷2 is used to allow a lower maximum operating frequency for the programmable divider.

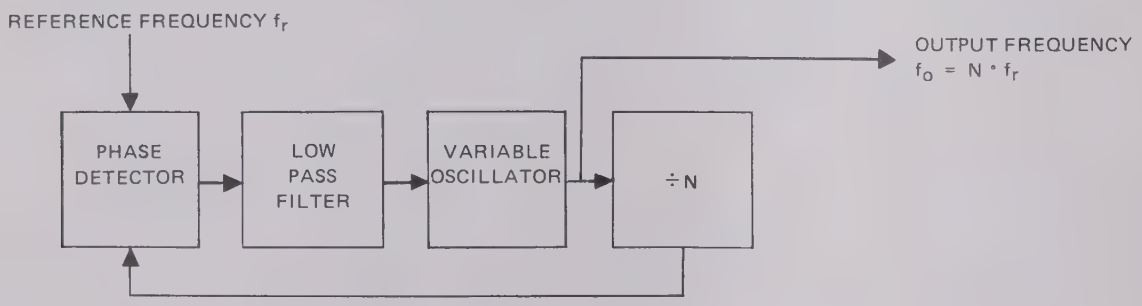


Figure 4-8. Simple Phase Lock Loop Block Diagram

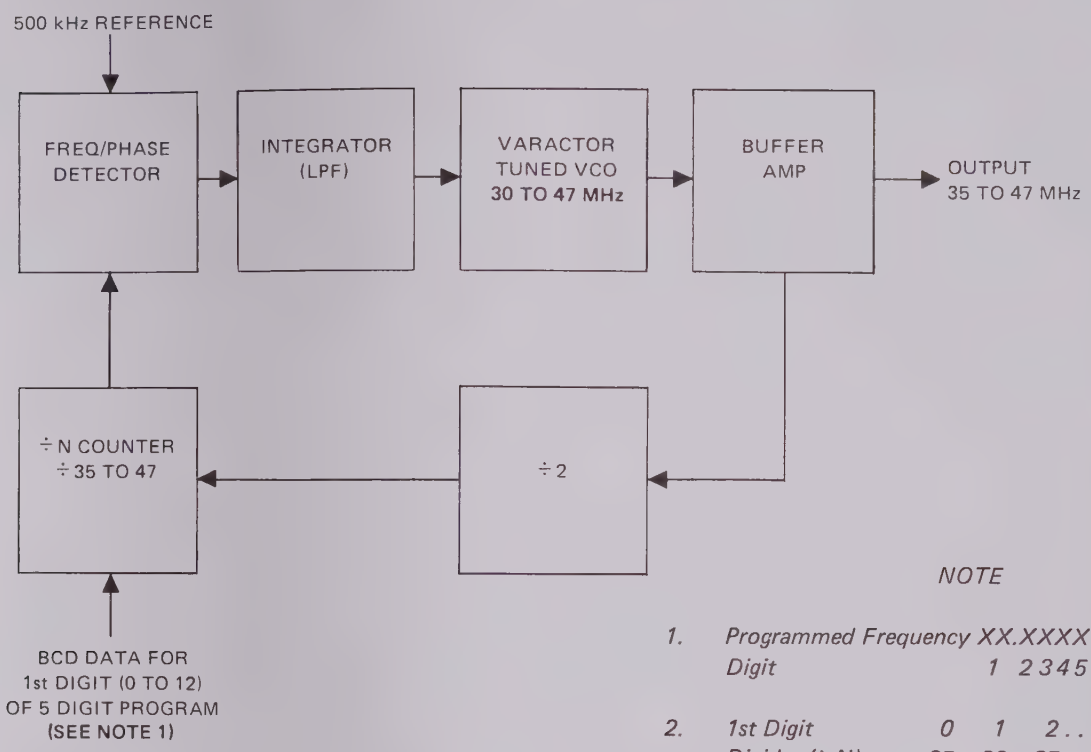

500 kHz REFERENCE
FREQ/PHASE DETECTOR
INTEGRATOR (LPF)
VARACTOR TUNED VCO 30 TO 47 MHz
BUFFER AMP
OUTPUT 35 TO 47 MHz
÷N COUNTER ÷35 TO 47
÷2
BCD DATA FOR 1st DIGIT (0 TO 12) OF 5 DIGIT PROGRAM (SEE NOTE 1)
NOTE
1. Programmed Frequency XX.XXXX
Digit 1 2345
2. 1st Digit 0 1 2 12
Divider (÷ N) 35 36 37 47
Output (MHz) 35 36 37 47

Figure 4-9. Digit 1 PLL (Part of -0509) Block Diagram

Figure 4-10 shows a slightly more complex PLL. In this loop, the VCO output is translated to a different frequency range before being divided by the ÷N counter. A bandpass filter follows a mixer to select either the resulting sum or difference frequency. This form of loop causes the VCO output to be different from N times the reference frequency by a fixed offset. Mathematically expressed, $f_O = Nf_r \pm f_m$.

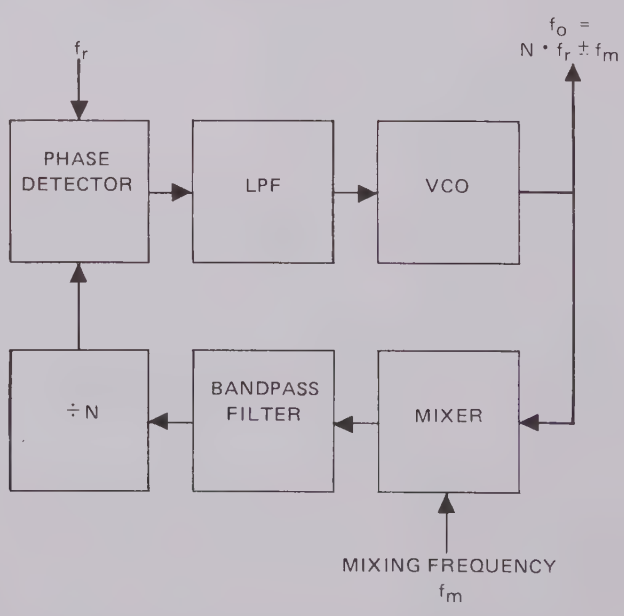
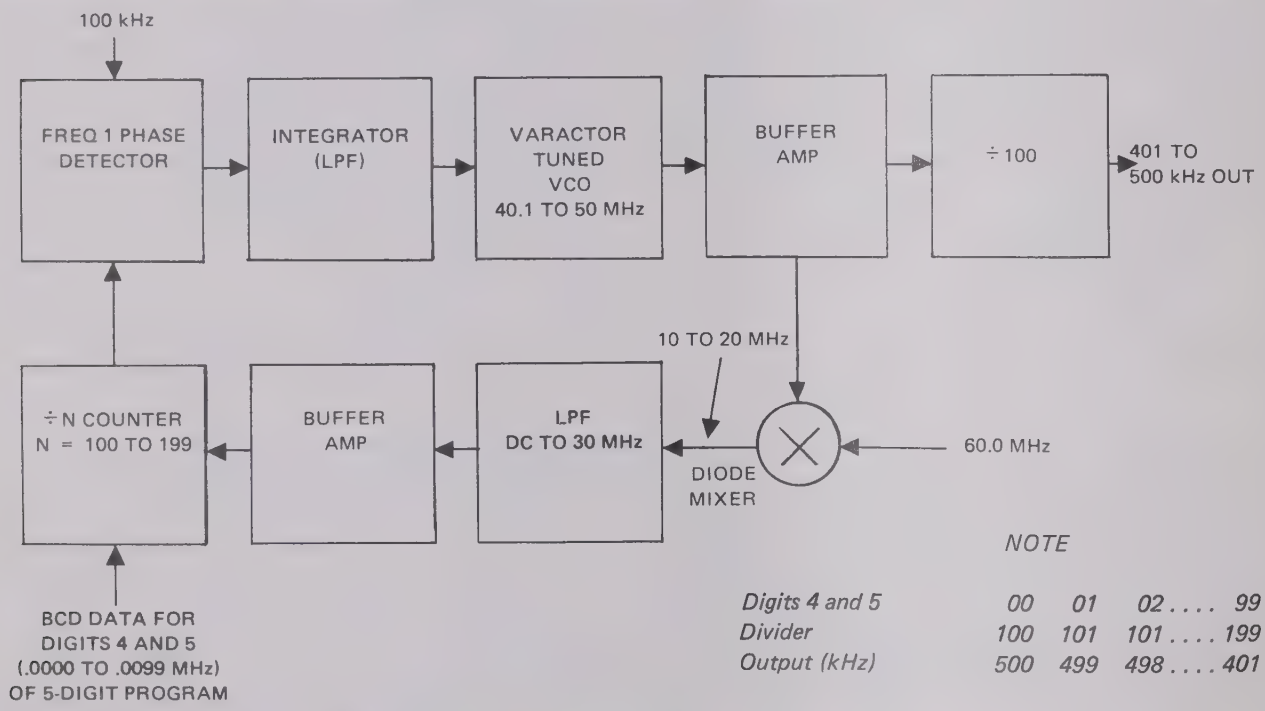


Figure 4-10. PLL With Mixer Block Diagram

Figure 4-11 shows the block diagram for digits 4 and 5 PLL. A fixed frequency of 60.0 MHz from the reference subsection is mixed with the 40 to 50 MHz VCO. The difference frequency (10 to 20 MHz) is passed through a 30 MHz low pass filter into a buffer amplifier. The amplified signal drives the divide by N counter, which divides the input frequency by a number ranging from 100 to 199, depending on the frequency setting of digits 4 and 5. The ÷N output is compared with a 100 kHz signal from the reference board in the phase detector. If there is a phase error, the phase detector will output a voltage pulse to the integrator which will change its output in the proper direction to reduce the VCO frequency error towards zero. The 4.01 to 50 MHz VCO output is divided by 100 to provide the desired 401 to 500 kHz output. The final 401 to 500 kHz output varies in 1 kHz steps as the ÷N ratio varies from 100 to 199. To obtain 500 kHz out, the required VCO frequency is 50 MHz. This mixes with the 60.0 MHz reference to produce a 10.0 MHz difference frequency. Digits 4 and 5 will both be zero in the case of a 500 kHz output, so the ÷N ratio will be 100. Dividing 10 MHz difference frequency by 100 will produce 100 kHz to compare with the 100 kHz reference. If digits 4 and 5 are set to 99, the ÷N becomes 199, and the VCO will be forced to 40.1 MHz, which will mix with 60 MHz to produce the difference frequency 19.9 MHz. The 40.1 MHz VCO will be divided by 100 to form the 401 kHz output.

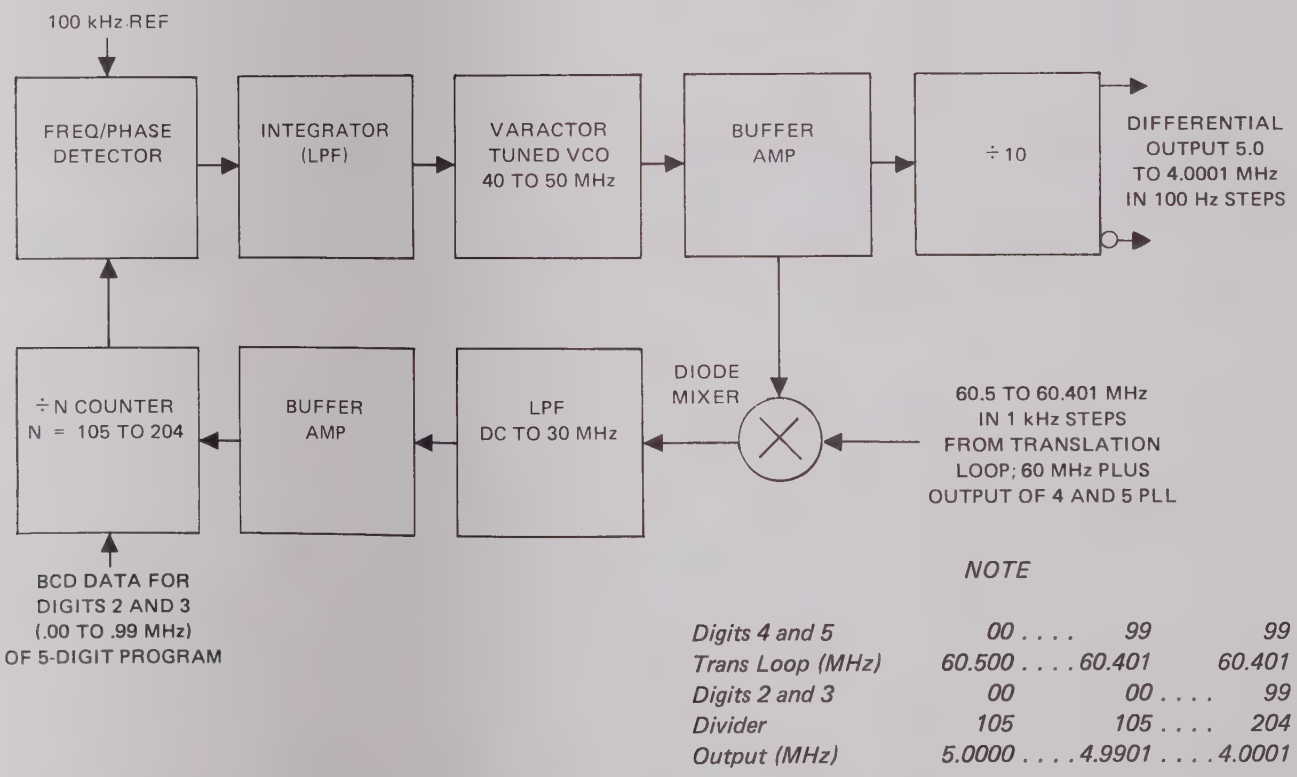

100 kHz
FREQ 1 PHASE DETECTOR
INTEGRATOR (LPF)
VARACTOR TUNED VCO 40.1 TO 50 MHz
BUFFER AMP
÷ 100
401 TO 500 kHz OUT
10 TO 20 MHz
÷N COUNTER N = 100 TO 199
BUFFER AMP
LPF DC TO 30 MHz
DIODE MIXER
60.0 MHz
BCD DATA FOR DIGITS 4 AND 5 (.0000 TO .0099 MHz) OF 5-DIGIT PROGRAM

NOTE

Digits 4 and 5	*00*	*01*	*02 . . . . 99*
Divider	*100*	*101*	*101 . . . . 199*
Output (kHz)	*500*	*499*	*498 . . . . 401*

Figure 4-11. Digits 4 and 5 PLL (Part of -0501) Block Diagram

Figure 4-12 shows the digits 2 and 3 PLL. This loop is almost identical to the digits 4 and 5 PLL. The offset frequency is 60.401 to 60.500 MHz instead of 60.0 MHz, and the ÷N counter ratio varies between 105 to 204 instead of 100 to 199. The VCO output is divided by 10 instead of 100, to form a 4 to 5 MHz output. If digits 4 and 5 are 00, the translation loop output to this loop will be 60.500 MHz. If digits 2 and 3 are 00, the ÷N ratio is 105. Under these conditions, the required VCO frequency is 50.0 MHz. This mixes with 60.5 MHz to produce a 10.5 MHz difference, which is divided by 105 in the ÷N to give a 100 kHz signal for the phase detector. Thus, the final output, after division, will be 5.0000 MHz. If digits 4 and 5 are set to 99, the translation loop output is 60.401 MHz. In this case, the VCO output has to be 49.901 MHz to satisfy the loop conditions, and the final output will be 4.9901 MHz. If digits 2 and 3 are also set for 99, the ÷N ratio will be 204, and a 40.001 MHz signal will be required from the VCO to mix with the 60.401 MHz to produce the 20.400 MHz difference frequency into the ÷N. In this case, the final output will be 4.0001. Thus, the output of this loop is seen to track changes in digits 4 and 5, as well as digits 2 and 3, which control the loop directly.


100 kHz REF
FREQ/PHASE DETECTOR
INTEGRATOR (LPF)
VARACTOR TUNED VCO 40 TO 50 MHz
BUFFER AMP
÷10
DIFFERENTIAL OUTPUT 5.0 TO 4.0001 MHz IN 100 Hz STEPS
÷N COUNTER N = 105 TO 204
BUFFER AMP
LPF DC TO 30 MHz
DIODE MIXER
60.5 TO 60.401 MHz IN 1 kHz STEPS FROM TRANSLATION LOOP; 60 MHz PLUS OUTPUT OF 4 AND 5 PLL
BCD DATA FOR DIGITS 2 AND 3 (.00 TO .99 MHz) OF 5-DIGIT PROGRAM

NOTE

Digits 4 and 5	*00 . . . .*	*99*	*99*
Trans Loop (MHz)	*60.500 . . . .*	*60.401*	*60.401*
Digits 2 and 3	*00*	*00 . . . .*	*99*
Divider	*105*	*105 . . . .*	*204*
Output (MHz)	*5.0000 . . . .*	*4.9901 . . . .*	*4.0001*

Figure 4-12. Digits 2 and 3 PLL (Part of -0500) Block Diagram

Figure 4-13 is a block diagram of the translation loop. Its function is to produce a signal 60 MHz higher than the 401 to 500 kHz signal from digits 4 and 5 PLL (i.e., 60.401 to 60.500 MHz). In this loop there is no divide by N. The VCO output is mixed with a 60.0 MHz reference frequency and the difference frequency is selected by a low pass filter, buffered, and applied directly to the frequency phase detector for comparison with the digits 4 and 5 output. The phase detector output drives the integrator to a voltage which sets the VCO to the proper frequency.

Figure 4-14 shows the mixer subsection and how the different loops connect together. As previously described, the digits 4 and 5 loop output is shifted upward to 60.401 to 60.500 MHz to drive the digits 2 and 3 loop. The output of the 2 and 3 loop varies from 4.0001 to 5.0000 MHz as a function of digits 2, 3, 4 and 5. This output is mixed with a 30.0 MHz signal in a double balanced modulator, and the sum of the two signals is selected by a 34 to 35 MHz bandpass filter. The output of this filter is mixed with the digit 1 loop output, 35 to 47 MHz, in a diode mixer and the difference frequency selected by a low pass filter. Take a frequency of 12.3456 MHz as an example. Digits 4 and 5 are set to 5 and 6, respectively. The output of the digits 4 and 5 PLL will be 444 kHz, and the translation loop will shift this up to 60.444 MHz. Digits 2 and 3 are set to 3 and 4; therefore, the output of the digits 2 and 3 PLL will be 4.6544 MHz, and, after mixing with 30.0 MHz, this will be 34.6544 MHz. Digit 1 is 12, so the output of the digit 1 PLL will be 47 MHz. This 47 MHz is mixed with 34.6544 and the difference is taken to form a 12.3456 MHz signal. This is the synthesizer section output which is then passed to the function generator. If the generator is set to the 1 to 13 MHz range, the function generator is phase locked directly to this signal. If the generator is on a lower range, the synthesizer output is divided by some power of 10 before the generator is locked to it.

Figure 4-15 is the block diagram of the reference subsystem. All reference frequencies are derived from a single, high stability, 10 MHz crystal controlled oscillator. This signal is multiplied by 3 to produce the 30 MHz reference, and this is then multiplied by 2 to form the 60 MHz reference. The 10 MHz is also divided by 20 to form a 500 kHz digital signal and this is divided by 5 to form a 100 kHz reference. If it is necessary to lock the synthesizer to an external 10 MHz system clock, the external clock is fed to a level detector/buffer amplifier. The output of the buffer amplifier and the internal 10 MHz oscillator are both fed to a phase detector, which in turn is fed to an integrator/low pass filter. If the external clock input is greater than 1 volt, a relay is closed automatically, connecting the integrator output to a variable capacitor for fine tuning the crystal oscillator. This locks the internal oscillator to the external system clock.

The block diagrams of figures 4-16 through 4-18 are printed circuit board oriented, showing which functions are related to what boards.

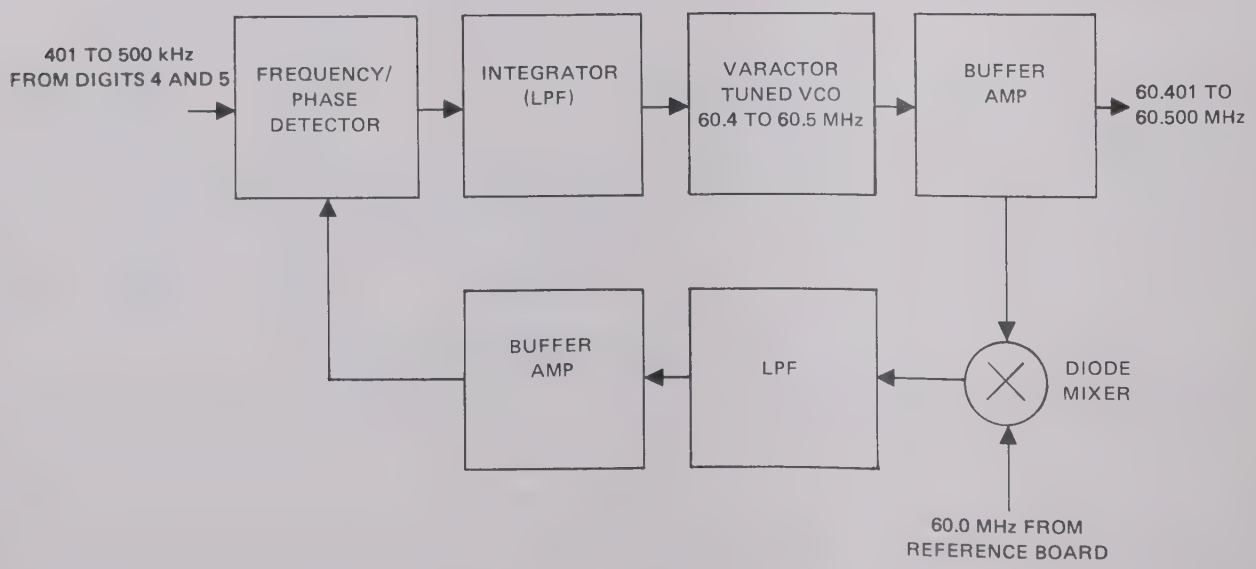


Figure 4-13. Translation Loop (Part of -0500) Block Diagram

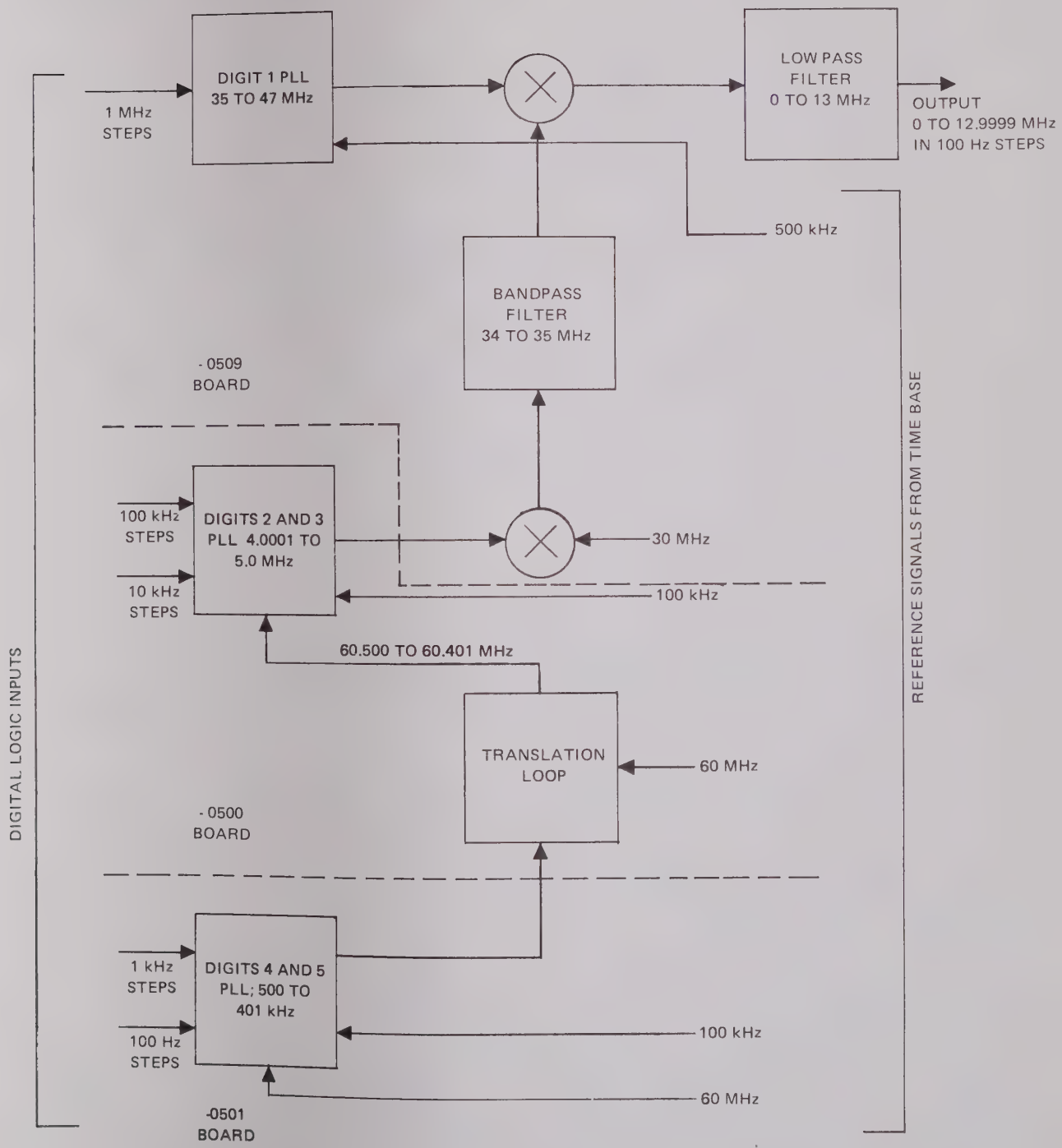


Figure 4-14. Synthesizer Block Diagram

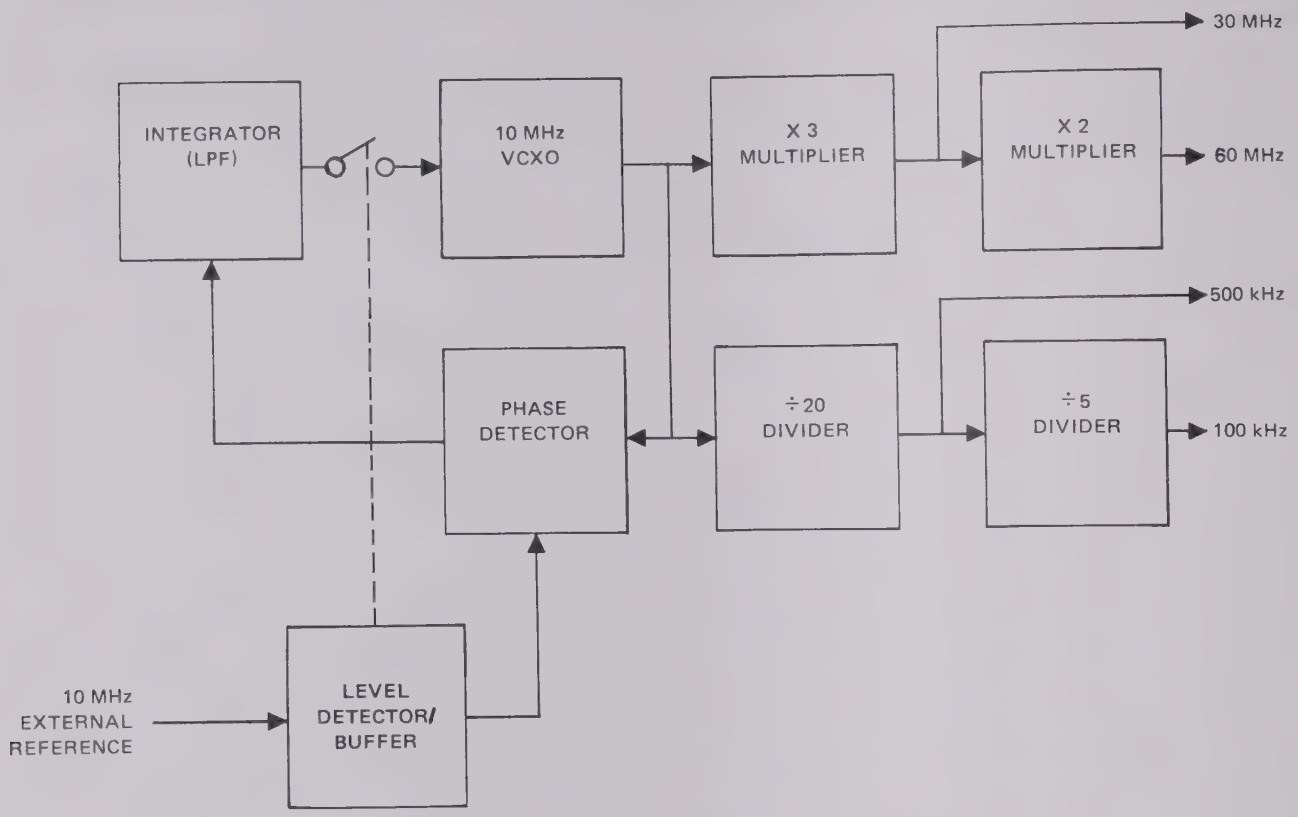


Figure 4-15. Reference Subsystem (Part of -0501) Block Diagram

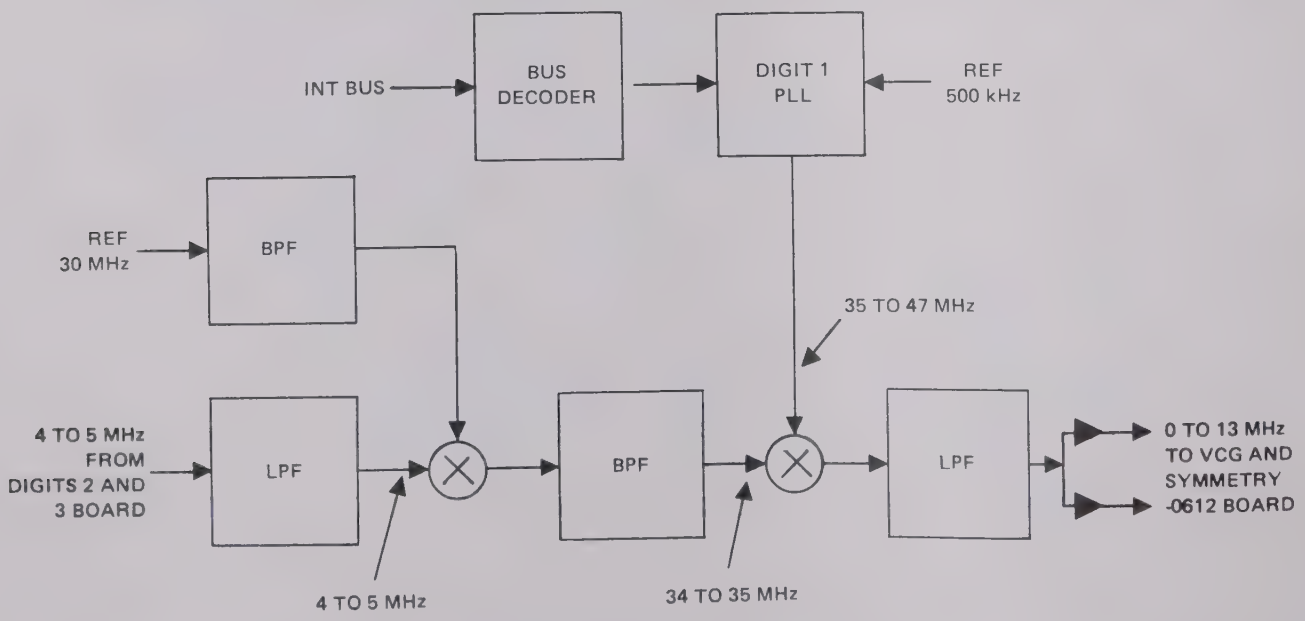


Figure 4-16. Digit 1/Mixer (-0509) Block Diagram

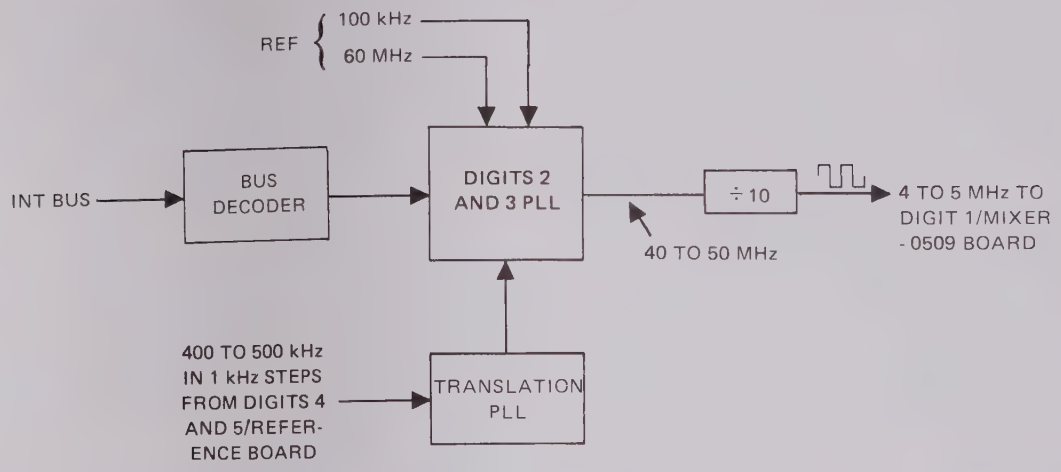

REF
100 kHz
60 MHz
INT BUS
BUS DECODER
DIGITS 2 AND 3 PLL
÷ 10
4 TO 5 MHz TO DIGIT 1/MIXER - 0509 BOARD
40 TO 50 MHz
400 TO 500 kHz IN 1 kHz STEPS FROM DIGITS 4 AND 5/REFERENCE BOARD
TRANSLATION PLL

Figure 4-17. Digits 2 and 3 (-0500) Block Diagram

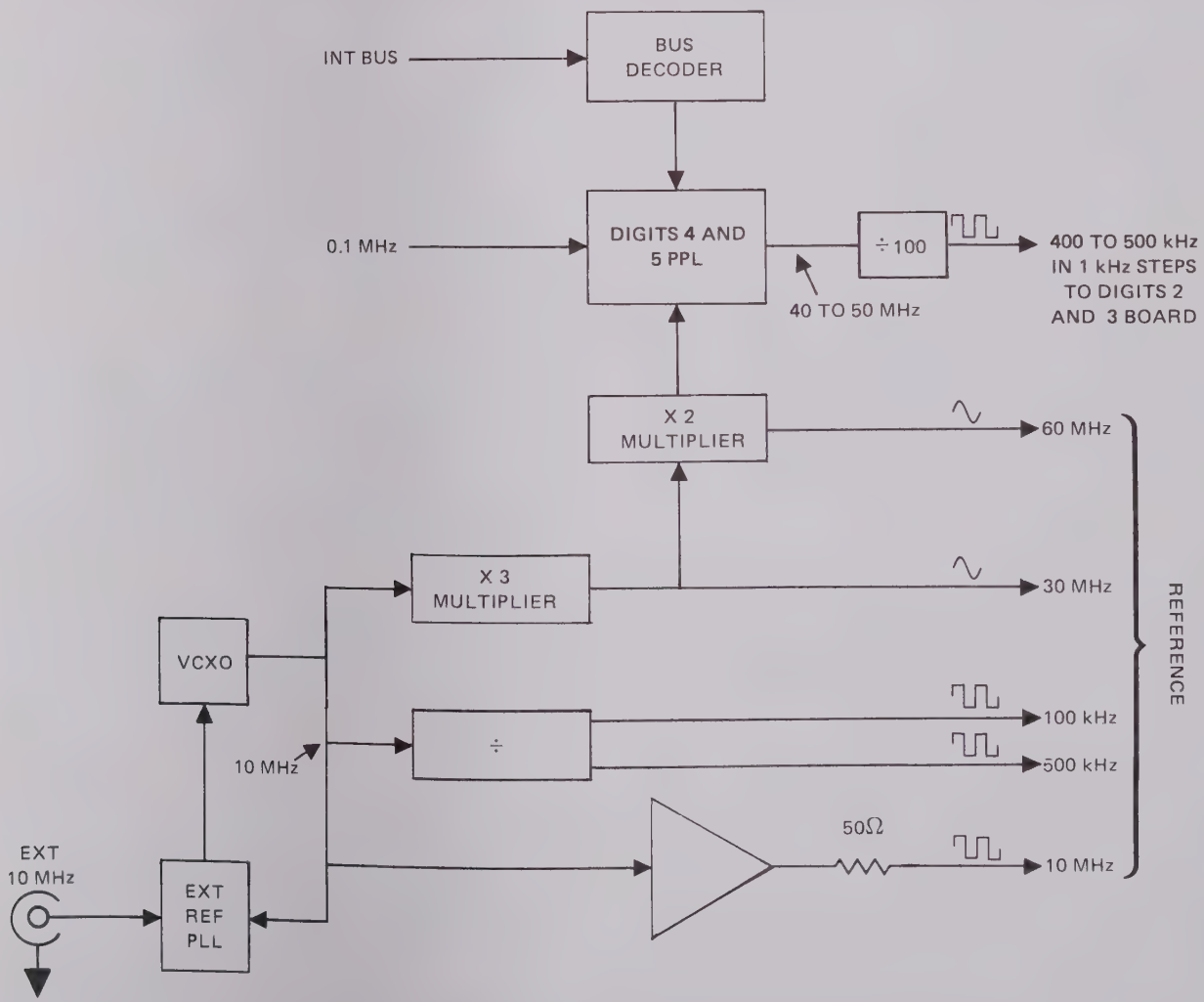


Figure 4-18. Digits 4 and 5/Reference (-0501) Block Diagram

4.8 FRONT PANEL OPTION

The front panel (Option 001) contains a 46 key keyboard and a 40 character alphanumeric display to allow the user to manually program the 172A and to learn its status under both manual and remote programming. The front panel also contains the power on/off switch. The front panel assembly is connected electrically by two cables. One cable is on the power switch and can be disconnected near the front panel. The other cable carries the keyboard and display signals and is plugged into the mother board at connector J20. The front panel assembly consists of three subassemblies: the keyboard, the self-scan display, and a PC board which interfaces to the microprocessor in the 172A. The microprocessor accesses the keyboard and display just as if they were read and write memory locations.

4.8.1 Keyboard

The keyboard itself consists of 46 printed circuit switches arranged in a 6 X 8 crosspoint array. The keyboard matrix is scanned by a keyboard encoder chip. When a contact closure is detected, the encoder stops scanning, provides a delay for contact bounce, latches a binary code onto its data output lines and provides a data ready strobe pulse. The output data is a binary number between 0 and 63 corresponding to the key depressed. When the keyboard contact closure is released, the encoder resumes scanning for the next closure. Periodically, the microprocessor, under program control, reads the encoder data output lines. The keyboard address is decoded on the microprocessor board and brought to the front panel as the keyboard out line. When this line is true, the encoder output is gated onto the 172A data bus lines, to be read by the microprocessor. The data ready strobe also triggers a 100 ms, 3 kHz audible tone each time a key is depressed.

4.8.2 Display

The display is a gas discharge device consisting of seven rows common to all character spaces, and 283 columns which are enabled consecutively, to display 40 characters on a 5 X 7 dot matrix, with two blank columns between characters. The display consists of a display panel and a driver board.

The information displayed on the front panel is stored in a Random Access Memory (RAM) located on the front panel PC board. Each character location on the display has a separate memory address into which the microprocessor can write. The six lower order address lines from the 172A address bus are used by the RAM as the display space addresses 0 through 39; the higher order address bits are decoded on the microprocessor board and brought to the front panel as the display enable line. When this line is true, the word appearing on the data lines 0 through 5 is written into RAM at the address appearing on corresponding address lines. Whenever the RAM is not being written into, its contents are being read to the display. The display requires a 20 kHz clock signal, valid data inputs for each particular character space, as that space is being scanned, and scan disable and reset signals to start each scan of the panel.

4.9 MICROPROCESSOR (-0647, -0493, -0494)

The microprocessor itself (figure 4-19) acts as the central processing unit, receiving information from the Wavetek and GPIB busses, the keyboard and the 172A subsystems and acting on these inputs as dictated by the software. Software directs the processor to address the 172A subsystems and issue commands and data which direct the 172A to output the desired signals.

Software refers to a sequence of commands executed by the 172A internal microprocessor. This sequence of instructions stored in PROM (-0494) commands the microprocessor to perform according to the 172A specification. The microprocessor is powerless without a program to run; therefore, the software is one of the most vital elements of the digital section. All information transfer takes place under the control or supervision of the software. Options are added to the Model 172A by adding to the microprocessor software, as well as the hardware. Programs are composed of machine language instructions, messages and tables that provide sequencing information. The program may be expanded by adding additional PROMs with properly coded initialization tables.

Program data from the PROM, temporary data from the RAM and input data from the keyboard or GPIB are hooked up to the microprocessor through an interconnection bus on the mother board. Data from the microprocessor software is sent to the rest of the instrument via a scratch pad memory. Table 4-1 indicates the format of the contents of the scratch pad.

The three boards of the microprocessor section (Microprocessor, Memory RAM, and Memory PROM) may be installed in locations C, D, E or F (see figure 4-1). The cards receive and drive a 43 wire data bus terminated on the mother board.

4.9.1 Microprocessor Board (-0647)

This board contains an eight bit processor (Signetics 2650), buffers, decoders and two I/O ports. Figure 4-19 shows the basic blocks of the microprocessor. Address lines are buffered to the mother board. Eight bi-directional data lines are received and driven to the mother board. Control signals necessary to describe the transaction are buffered to the mother board. Ten megahertz clock pulses are generated and buffered to the mother board. Clocks are available down to 625 kHz for other processor cards. All these signals

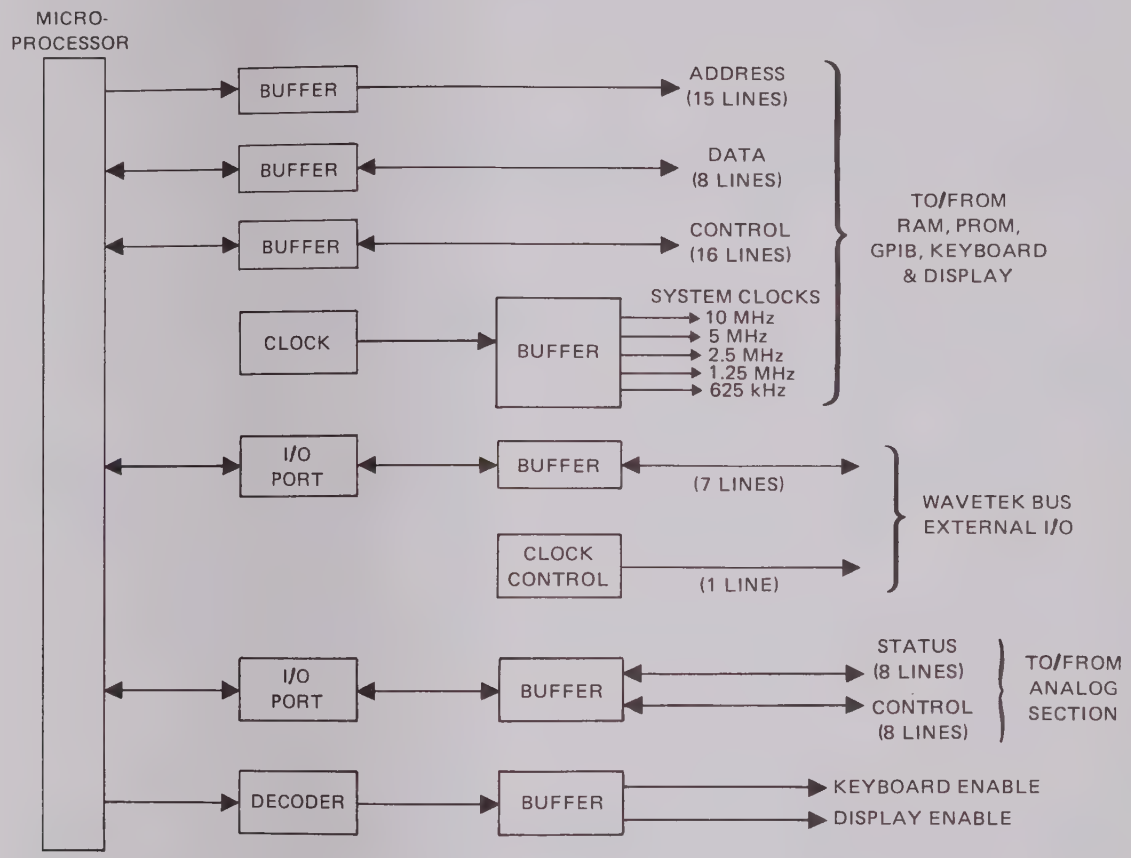


Figure 4-19. Microprocessor Board (-0647) Block Diagram

are common to the processor section, but are not carried to the analog sections of the instrument (function generator and synthesizer).

A Wavetek bus input/output is interfaced to the microprocessor with a Signetics 8T31 I/O port and clock control logic. The processor clears this port by writing a null character at power-on time. Any character received by this I/O port will be latched until the processor indicates the byte has been recorded. The busy line will be asserted during this period. A one character delay is inserted on this bus to allow the processor to load the output register while the bus is busy. (The Wavetek bus insures data accuracy only while the clock is asserted.)

The second I/O port generates eight control lines sent to the analog section of the instrument. These control lines are used to provide the microprocessor a facility to trigger the instrument or provide other control functions as options.

Eight status lines are sent to the microprocessor to indicate that a synthesizer has been installed and if the synthesizer is phase locked.

Five unit select switches are mounted on the microprocessor board. These switches represent the address of the instrument on the Wavetek bus. This address is independent of the GPIB (option 005) device address.

4.9.2 Memory PROM Board (-0494)

The memory PROM (figure 4-20) contains space for 16,384 bytes of fixed memory. Each memory chip provides non-volatile storage for 512 eight bit words. Addresses from the mother board are buffered and sent to each chip installed on the board. The address space in the 172A is allocated to location 0 through FFF_{16} (4095_{10}) and 4000_{16} to $6FFF_{16}$ ($12{,}287_{10}$). These memory locations are referenced by the microprocessor by asserting an operation request with a read transaction. If the address is within the PROM space, data will be placed on the data bus and operation acknowledge asserted until the microprocessor resets operation request.

Integrated circuit memories are installed on the PROM board to support the basic program in the 172A.

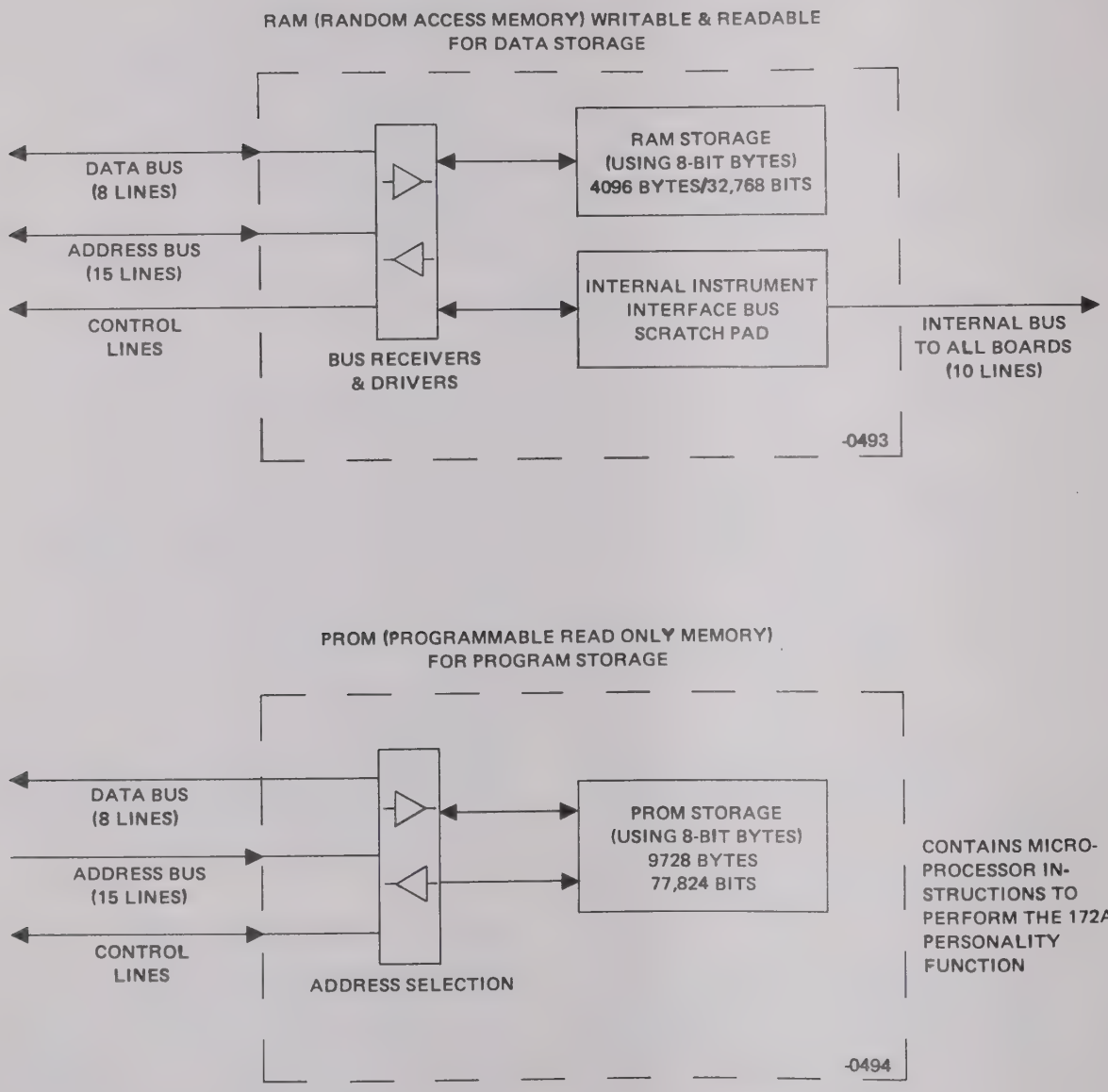


Figure 4-20. RAM Memory Board (-0493) and PROM Memory Board (-0494) Block Diagram

Table 4-1. Scratch Pad Memory Format

Data Sending Sequence	Address				Sign Bit		Data Byte								
	Group		Byte												
		A3 A2		A1 A0	S	Description	D7 D6 D5 D4	Description	D3 D2 D1 D0	Description
0	OFFSET (00)	0 0	0	0	0 1	+ OFFSET – OFFSET	0 0 0 0 ↓ 0 1 1 1	DC OFFSET MSD $0 - 7_{10}$	0 0 0 0 ↓ 1 0 0 1	DC OFFSET MD $0 - 9_{10}$
1		0 0	0	1				NOT USED	0 0 0 0 ↓ 1 0 0 1	DC OFFSET LSD $0 - 9_{10}$
2		0 0	1	0				NOT USED		NOT USED
3		0 0	1	1				NOT USED		NOT USED
4	FREQUENCY (01)	0 1	0	0			0 0 0 0 ↓ 1 1 0 0	FREQUENCY MSD (5) $0 - 12_{10}$	0 0 0 0 ↓ 1 0 0 1	FREQUENCY DIGIT (4) $0 - 9_{10}$
5		0 1	0	1	0 1	FREQ MULT + FREQ MULT –	0 0 0 0 ↓ 1 0 0 1	FREQUENCY DIGIT (3) $0 - 9_{10}$	0 0 0 0 ↓ 0 1 1 0	FREQ MULT $10^{-4} \rightarrow 10^{0}$ $\rightarrow 10^{+6}$
6		0 1	1	0			0 0 0 0 ↓ 1 0 0 1	FREQUENCY DIGIT (2) $0 - 9_{10}$	0 0 0 0 ↓ 1 0 0 1	FREQUENCY DIGIT (1) $0 - 9_{10}$
7		0 1	1	1				NOT USED		NOT USED
8	AMPLITUDE (10)	1 0	0	0	0 1	NORMAL INVERTED (OUTPUT)	0 0 0 0 ↓ 1 1 1 0	AMPLITUDE MSD $0 - 14_{10}$	0 0 0 0 ↓ 1 0 0 1	AMPLITUDE MD 0 - 9
9		1 0	0	1	0	AMPL MULT + AMPL MULT –	0 0 0 0 ↓ 1 0 0 1	AMPLITUDE LSD $0 - 9_{10}$	0 0 0 0 ↓ 0 0 1 1	AMPL MULT $10^{0} \rightarrow 10^{-3}$ 0 dB → –60 dB
A		1 0	1	0				NOT USED		NOT USED
B		1 0	1	1				NOT USED		NOT USED

Table 4-1. Scratch Pad Memory Format (Continued)

Data Sending Sequence	Address				Sign Bit		Data Byte								
	Group		Byte												
	A3	A2	A1	A0	S	Description	D7	D6	D5	D4	Description	D3	D2	D1	D0	Description
C	1	1	0	0							Function					Mode
							0	0	0	0	SINE	0	0	0	0	CONTINUOUS
							0	0	0	1	TRIANGLE	0	1	0	0	GATED
							0	0	1	0	SQUARE	0	1	0	1	TRIGGERED
							0	1	0	0	DC	0	1	1	0	GATED HAV
												0	1	1	1	TRIG HAV
												1	0	0	0	SYNTHESIZE*
												1	0	0	1	EXT LOCK
D	1	1	0	1							Symmetry					Load
							0	0	0	0	50%					Output Load
							0	0	0	1	10%			0	0	OFF OUT
							0	0	1	0	20%			0	1	OFF IN
							0	0	1	1	30%			1	0	ON OUT
							0	1	0	0	40%			1	1	ON IN
							0	1	0	1	50%					
							0	1	1	0	60%					
							0	1	1	1	70%					
							1	0	0	0	80%					
							1	0	0	1	90%					
E	1	1	1	0							NOT USED					NOT USED
F	1	1	1	1							NOT USED					NOT USED

MODE & MISCELLANEOUS (11)

*Option

In figure 4-21, locations B2 through B9 contain basic language software required to execute the 172A programs. Locations B10, B11 and B13 contain the GPIB software. Locations B14 through B17 contain machine language routines which must be installed. Locations A12 through A17 contain the operating program for the 172A. Options may be installed in any open location, A2 through A11 or B12. Optional PROMs are constructed to be installed in any available locations, including PROMs that contain instrument settings.

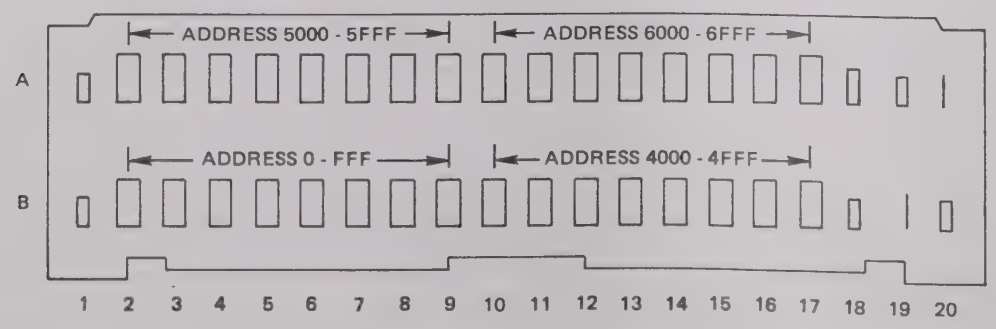


Figure 4-21. PROM Locations

4.9.3 Memory RAM Board (-0493)

The memory RAM board (figure 4-20) contains 4096 eight bit bytes of volatile storage composed of eight 4K X 1 dynamic RAM chips. Refresh logic is located on this board with the logic necessary to arbitrate between a refresh cycle and a microprocessor cycle. In addition, the RAM board contains a 16 byte read/write scratch pad memory that transmits all data to the analog section of the instrument in 5 μs.

The RAM address is set to 1000 through $1FFF_{16}$. A read or write is initiated by the microprocessor by issuing an operation request within the address space 1000_{16} to $1FFF_{16}$. If a refresh cycle is not in progress, data are accepted or presented depending upon the transaction requested on the data bus and an operation acknowledge is asserted. Data are latched until accepted and the microprocessor has removed the operation request signal.

The RAM stores the current setting, command strings, error reports, status and locations of option PROMs. If optional stored setting PROMs are installed, the RAM will store up to 100 complete instrument settings. The contents of the RAM are lost whenever power is shut down.

The RAM card includes a 16 byte scratch pad memory containing the data to be sent to the analog sections of the instrument. Data are transferred at a rate of four BCD characters per microsecond along with four address lines to all analog modules. Each line is terminated on the mother board. Scratch pad locations are accessed by the microprocessor and filled with properly formulated data for each analog module. Table 4-1 indicates the location of the data transferred to analog modules. All data are coded in four bit BCD digits. There is frequency and amplitude overranging in the most significant digits, as indicated by 12_{10} and 14_{10}, respectively, in table 4-1.

These values may differ from those transmitted to the instrument from a controller. The microprocessor selects its method of getting the output, then fills the scratch pad with properly formatted data. Data are sent to analog modules only when an execute command or GET is received.

4.9.4 Data Format

Offset — Three digits of offset are transferred with an allowable value in the range of 0 ±7.49. The amplitude range digit will determine the actual voltage range selected.

Frequency — Five digits of frequency plus one range digit and sign are transferred within 2 μs. The function generator receives three digits from scratch pad locations 4 and 5 and one range digit plus sign bit. The synthesizer receives all five digits, but does not store the range digit. The most significant digit may be overranged to 12 on the 10^6 range for a maximum frequency of 12.9999 MHz. The range digit is the power-of-ten multiplier required (the decimal point follows the most significant digit.)

Amplitude — Three digits of amplitude are transferred to the attenuator module and one digit to the power amplifier attenuator. Sign bits for amplitude and range digits are also transferred.

The MSD of amplitude may be overranged to a value of 14.99 by transferring a 14 in the most significant digit on the top range (10^0). Therefore, the amplitude value can extend from 0 to 999 and be overranged to 14.99. All digits are BCD coded, sign-magnitude fashion (3 digits). An asserted sign bit indicates a negative value. The value is not complemented if the sign bit is set.

Symmetry — A one digit value from 0 to 9 selects the symmetry required. Zero and five select 50% while digits 1 through 9 select symmetries at 10% intervals.

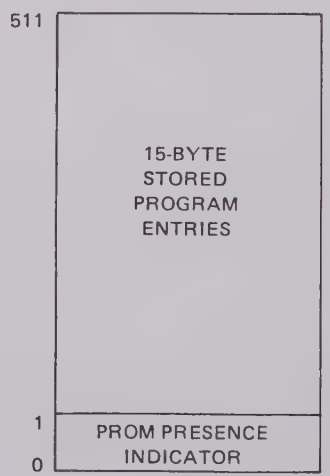
Function — A one digit value selects the requested function. These values differ from those used to command the instrument from the keyboard or the GPIB.

Mode — A one digit value selects one of seven modes. These values differ from those used to command the instrument from the keyboard or the GPIB.

Load — A one digit value selects the load and enables the output. These values also differ from those used to command the instrument from the keyboard or GPIB.

4.10 STORED PROGRAM PROM FORMAT

A PROM holding the stored programs is divided into two areas, as follows:



4.10.1 PROM Presence Indicator

The PROM presence indicator is a single byte coded with a hex value of 55.

4.10.2 Stored Program Entries

Each stored program is contained in a 15 byte entry as diagrammed below.

1	2	3	4	5
AØ	ØF	UPPER 1 X	LOWER X X	OFST DIGITS 1 & 2

STORED SETTINGS TABLE ENTRY INDICATOR

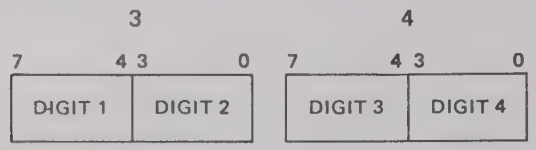
PROGRAM ID: 4 DIGIT BCD NO. BETWEEN 1000 AND 1999

6	7	8	9	10
OFST DIGIT 3	FREQ DIGITS1 & 2	FREQ DIGIT 3&EXP	FREQ DIGITS 4 & 5	AMPL DIGITS 1 & 2

11	12	13	14	15
AMPL DIGIT 3 & EXP	FUNC MODE	SYM & LOAD	SIGNS	FDC MDC

Bytes 1 and 2 contain a code informing the 172A microprocessor that a stored program entry follows of size 15 (hex F) bytes. Bytes 3 and 4 hold the program ID. This is the identifying value with which the instrument user accesses the stored program associated with this table entry. It is coded as a BCD number between 1000 and 1999.

Bytes 3 and 4:

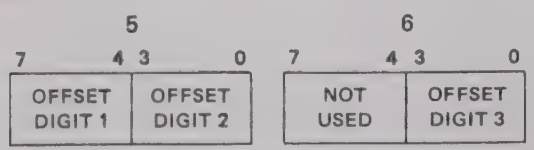


Bytes 5 through 15 hold the stored program data. The 15 byte program entries must be packed together starting at PROM address 1, with no gaps. A 512 byte PROM can hold 34 settings.

4.10.3 Stored Program Data

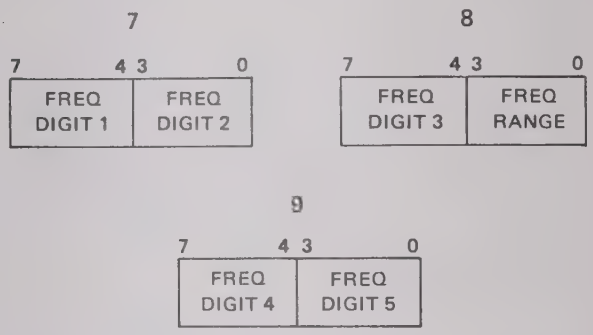
The stored program data is a series of 11 bytes (numbered 5 through 15) containing a complete set of specifications for the analog circuits of the instrument. These bytes are formatted as follows.

Bytes 5 and 6:



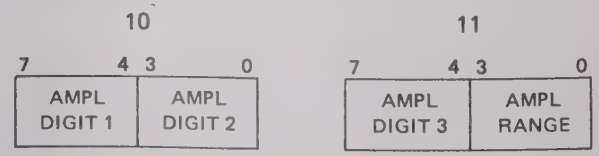
These bytes hold the offset magnitude (3 digits; digit 1 most significant). Note that the offset and amplitude both use the amplitude range digit (in byte 11) to set range. The offset is limited to 7.49 maximum (the decimal point is between digit 1 and digit 2). See the amplitude programming information below (bytes 10 and 11) for further limitations on this field.

Bytes 7, 8 and 9:



These bytes specify the instrument frequency. Digits 4 and 5 are used only by the synthesizer. The decimal point is between digit 1 and digit 2. For maximum accuracy, digit 1 should be nonzero. Digit 1 may be overranged by programming it with A, B or C (hex); i.e., the BCD values 10, 11 or 12. Then, when digit 1 is overranged, a total of six digits are available for programming (digit 1 accounting for two). For example, the value 12.3456 is encoded as C3456 (hex) in the five magnitude digits. The range digit, in conjunction with the frequency range sign bit described below, specifies ten to a power, which is multiplied by the value in the five frequency magnitude digits to select a frequency (in hertz). The frequency range may be programmed with any value from –4 to +6.

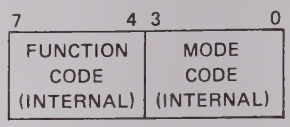
Bytes 10 and 11:



These digits select the instrument output amplitude. The decimal point is between digit 1 and digit 2. The three amplitude magnitude digits may be overranged using values A, B, C, D and E (hex), (for a maximum BCD value of 14.99 = E99) in a manner similar to that described above for frequency. Because the output amplifier is limited to 7.5 volts peak, the sum (ignoring sign bits) of the offset digits (bytes 1 and 2) and half the amplitude digits (bytes 10 and 11) may not exceed 7.5. If this occurs, it is necessary to shift both amplitude and offset right one digit and increase the range by one to get the desired output.

The range digit, in conjunction with the amplitude range sign bit, specifies ten to a power which multiplies the values of both the amplitude and offset magnitudes (including their respective sign bits) to select output amplitude and offset (in volts). The amplitude range may be programmed with any value from +0 to –3.

Byte 12:



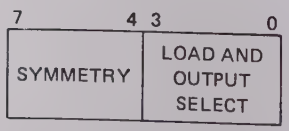
This byte selects the instrument function (upper hex digit) and mode (lower hex digit). Codes for function are:

Code (hex)	Function
0	Sine
1	Triangle
2	Square
4	DC

Codes for mode are:

Code (hex)	Mode
0	Continuous
4	Gated
5	Triggered
6	Gated haverwave
7	Triggered haverwave
8	Synthesized
9	External Phase Lock

Byte 13:



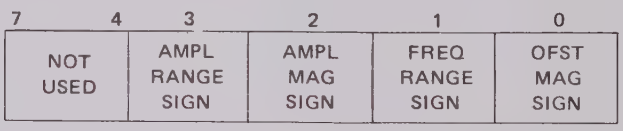
This byte selects the instrument symmetry (upper hex digit) and 50Ω load and output (lower hex digit). Codes for symmetry are:

Code	Symmetry Value
0	50%
1	10%
2	20%
.	.
.	.
.	.
9	90%

Codes for load and output select are:

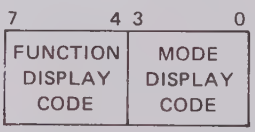
Code	50Ω Load and Output Selection
0	Load and output disconnected
1	Load connected, output disconnected
2	Load disconnected, output connected
3	Load and output connected

Byte 14:



This byte holds the signs of the amplitude magnitude (bytes 10 and 11), amplitude/offset range (byte 11), frequency range (byte 8) and offset magnitude (bytes 5 and 6). Signs are coded positive = 0, negative = 1.

Byte 15:



This byte holds the display codes for mode and function. They are not used to program the analog portion of the instrument, but are used to provide the correct display on the front panel. Function display code values are (hex):

Internal Code	Display Code
0	0 (Sine)
1	1 (Triangle)
2	2 (Square)
4	4 (DC)
(No internal codes for the pulses)	6 (+ Pulse)
	7 (– Pulse)

Mode display code values are (hex):

Internal Code	Display Code
0	0 (Cont)
4	2 (Gated)
5	1 (Triggered)
6	5 (Gated Haverwave)
7	4 (Triggered Haverwave)
8	3 (Synthesizer)
9	6 (External Phase Lock)

The hex listing in table 4-2 is an example of a PROM programmed with three programs, numbers 1000, 1001 and 1100. The instrument settings are specified in table 4-3.

Table 4-2. Hexadecimal Listing of Stored Program

Address (Hex)															
0 thru F	55	A0	0F	10	00	00	00	10	30	00	10	00	00	00	00	00
10 thru 1F	A0	0F	10	01	10	00	24	51	00	02	31	24	33	0B	22	A0
20 thru 2D	0F	11	00	05	02	C3	46	56	D5	70	18	02	04	13		

NOTE: 1. Programs start at 1, 10 and 1F.

2. Program entry for program 1000 underlined.

In program 1001, the offset is in the 10^{-1} range, while the amplitude is in the 10^{-2} range. Since the amplitude and offset both use the same range digit, it is necessary to first select the largest range of the two (in this case −1) as the value to be programmed into the amplitude range, and then to shift the magnitude value of the smaller setting (in this case 23 mV) so that it will program the instrument to the desired value using the larger range digit. Thus, in this example we have to adjust an amplitude setting at 2×10^{-2} to be compatible with a range of −1, which is accomplished by rewriting it as 0.23×10^{-1}, and then programming the three amplitude magnitude digits with the values 0, 2 and 3. Note that this causes the loss of a significant digit of amplitude programming. In program 1100, examples of the use of overranging are given. Note the additional digit of programming.

Table 4-3. Instrument Settings for Table 4-2

	Program		
Parameter	1000	1001	1100
Amplitude	1 volt	23 mV	−13.57V
Offset	0 volts	−100 mV	0.52V
Frequency	1 kHz	245 mHz	12.3456 MHz
Mode	Continuous	Gated	Synthesized
Function	Sine	Square	Triangle
Load	Load & Output Disconnected	Load & Output Connected	Output Connected, Load Disconnected
Symmetry	50%	30%	50%

4.11 GPIB/MICROPROCESSOR INTERFACE (-0643, -0554; AN OPTION)

The GPIB/microprocessor interface allows the instrument to be remotely programmed by a minicomputer, calculator, etc., via the General Purpose Instrument Bus (GPIB). The GPIB interface is an implementation of IEEE Standard 488-1975. It supports the following 488-1975 defined interface functions: Source Handshake (SH1), Accepter Handshake (AH1), Talker (T6), Listener (L4), Service Request (SR1), Remote Local (RL2), Device Clear (DC1) and Device Trigger (DT1). This bus transfers messages in bit parallel and byte serial fashion. The bus has 16 signal lines, and they are:

8 Data lines (DIO1 through DIO8)
5 Control lines (ATN, IFC, SRQ, EOI and REN)
3 Handshake lines (NRFD, NDAC and DAV)

These lines are defined in paragraph 3.6, as is operation with the GPIB.

The GPIB/microprocessor interface does the following three functions:

1. Detects the My Listen Address (MLA) and My Talk Address (MTA).

2. Does the proper listen handshake when either attention (ATN) is true, or the listen latch is set, and transfers messages when the talk latch is set.

3. Provides isolation through optical couplers.

In order to reduce the number of opto-isolators, the messages are transferred in bit serial fashion through two Universal Asynchronous Receiver/Transmitters (UART). (See figure 4-22.) All 16 GPIB lines are buffered and terminated through bus transceivers. The UART and status outputs are connected to the microprocessor data line via tri-state buffers.

The operation of the UART is fairly simple. Each UART consists of two independent sections called receiver and transmitter, and both of them may operate simultaneously. The UARTs are primarily used to convert parallel information into serial and serial information into parallel. The re-

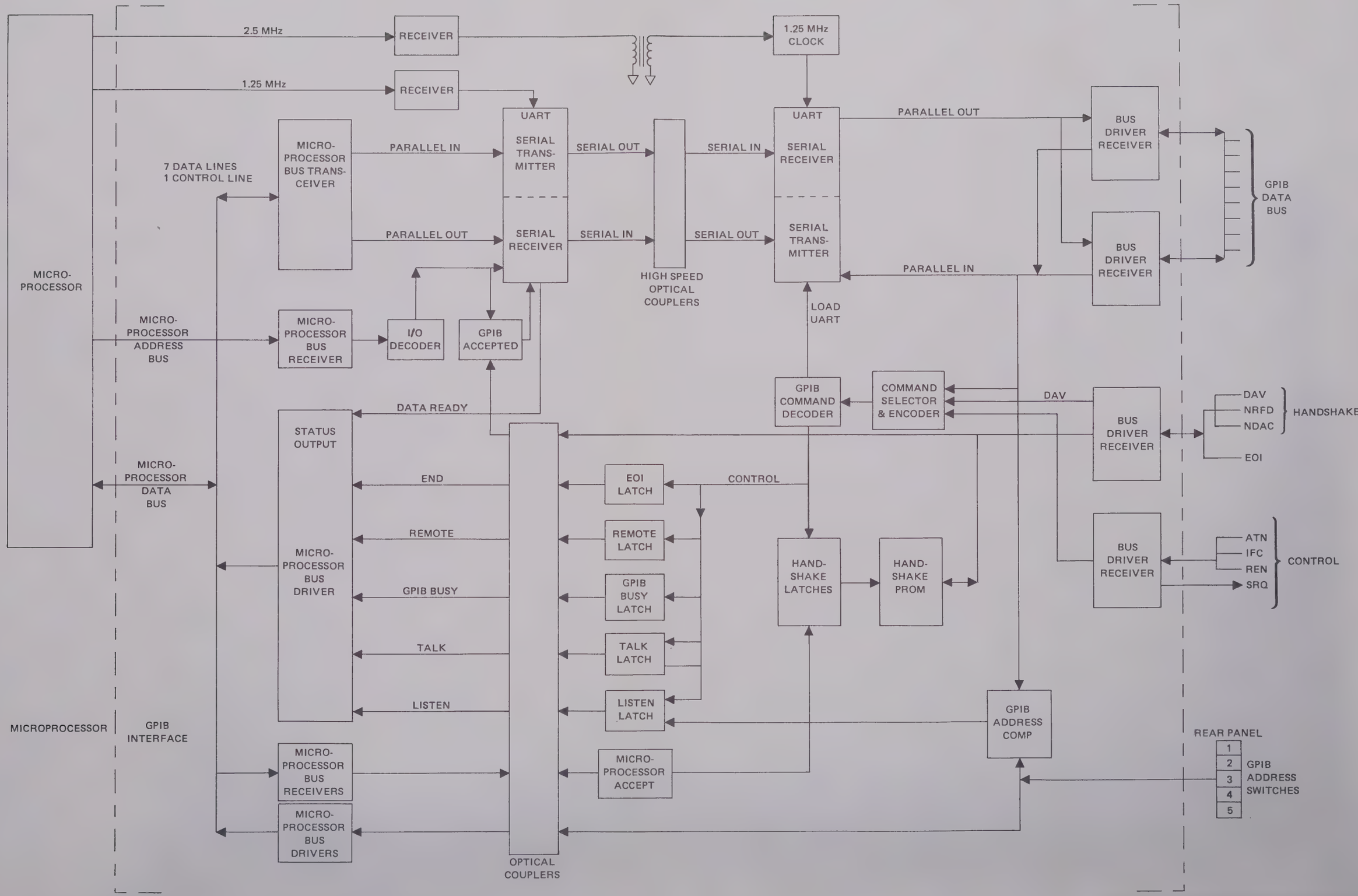


Figure 4-22. GPIB/Microprocessor Interface Block Diagram

ceiver receives its information in serial and converts it into an 8 bit parallel byte, whereas the transmitter converts an 8 bit parallel byte into bit serial output. The transfer rate of the serial output is determined by the clock frequency of the UART. Here the UART clock frequency is set at 1.25 MHz.

The interface completely insulates the microprocessor from GPIB and hence the microprocessor is relieved from the GPIB transactions. The microprocessor constantly monitors the status outputs from the interface and takes actions according to that. There are six status bits tied to the microprocessor data bus: Data Ready, GPIB Busy, End, Remote, Talk and Listen.

4.11.1 Data Ready

The Data Ready bit informs the microprocessor that the UART has received valid data from the GPIB. Only when this bit is true, will the microprocessor read the byte from the UART.

4.11.2 GPIB Busy

The GPIB Busy bit is used during the talk mode to find out whether GPIB has accepted the data byte sent through the UART. Any time the microprocessor wants to send a byte via GPIB, first it checks that the Talk status bit is true and then it checks that GPIB Busy status bit is false. If the GPIB Busy status is false, then the microprocessor will load a byte into the UART and cause the GPIB Busy signal to go high (true). This prevents the microprocessor from loading any more bytes into the UART. The byte loaded into the UART is transmitted serially across the opto-coupler to the GPIB side of the UART. When all the 8 bits of the byte are present, the data valid (DAV) line is set low. When the listener on the GPIB senses the DAV line is low, he accepts the byte by raising the data accepted (NDAC) signal high. The NDAC signal is received and causes the GPIB Busy signal to go low (false). Once the GPIB Busy signal goes low, the microprocessor can transmit another byte in the same manner.

4.11.3 End

The End bit is monitored by the microprocessor any time it reads a byte from the UART. If this bit is true, then the microprocessor assumes that it has received the last byte of the message sequence and treats it as a terminating character.

4.11.4 Remote

The Remote bit indicates to the microprocessor whether the 172A is in remote control or local control.

4.11.5 Talk

The Talk bit will be set any time the 172A receives its assigned talk address. When the microprocessor senses this bit as true, it sends the appropriate talk message.

4.11.6 Listen

The Listen bit will be set any time the 172A receives its assigned listen address. When the microprocessor senses this bit as true, it prepares to receive the data bytes through the UART.

4.11.7 Service Request

Service Request (SRQ) is a bit sent by the microprocessor to the GPIB when it wants to talk. The controller will eventually cause a talk status bit to be generated and allow the microprocessor to place a talk byte on the interface.

4.12 POWER SUPPLY

The power supply consists of the Pass Transistor board (-0634), the Power Supply Regulator board (-0633) and the rear panel mounted transformer. The pass transistor board contains power transistors plus three IC regulators for the power supplies, while rectifier, regulator, reference and sensing circuits are on the regulator board.

The +24 volt voltage reference is a zener diode, and the –24 volt supply, in turn, uses the +24 volts as reference. (See figure 4-23.) The regulator sections are current limiting stages, which limit the power supply current under supply overload conditions. The + and –15 volt supplies (not shown in figure 4-23) operate in the same manner.

The +12, –5 and isolated +5 volt supplies (not shown in figure 4-23) use IC regulators located on the pass transistor board. The ground reference for the isolated +5 volt supply is isolated from common ground. System ground, isolated +5 volt ground and chassis ground are isolated from one another.

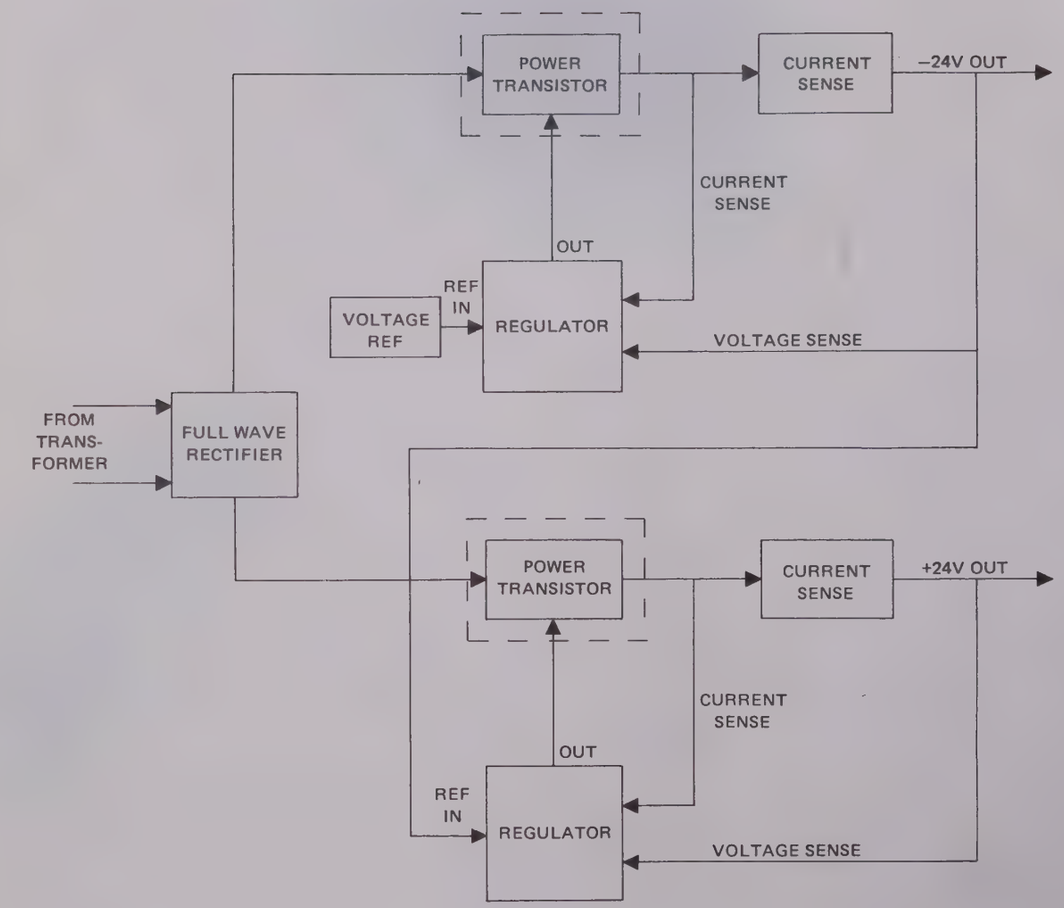


Figure 4-23. Power Supply Block Diagram

SECTION 5
TROUBLESHOOTING

5.1 INTRODUCTION

Faults may be isolated to circuit board, power supply or front panel. Familiarize yourself with the 172A by reviewing the operating procedures in this manual as well as the circuit descriptions. Successful fault isolation depends upon a thorough knowledge of the correct instrument operation.

Major groups of the various assemblies are shown in table 5-1. Fault isolation is discussed in the following paragraphs in terms of these groups. The locations of boards and assemblies called out in table 5-1 are shown in figure 4-1.

5.2 POWER SUPPLY

In case the generator is malfunctioning, power supply voltage is always the first thing to be checked. Test points for all power supplies are on top edge of the power supply and regulator board (-0633). Table 5-2 shows the supply distribution to each PC board.

If the power supply voltage is found to be lower than normal, it indicates there is an overloaded or short circuit condition in the system. Turn off the generator immediately to avoid further damage. Remove all PC boards that use the

Table 5-1. Assembly Guide

Assembly No.	Board Ejector Color	Assembly	Group
-0634 -0633 -0614	Black Black NA	Pass Transistor/Regulator Power Supply Regulator Rear Panel (Transformer, Capacitors, etc.)	Power Supply
-0612 -0635 -0490 -0590 -0638	Yellow Green Blue Gray Violet	VCG and Symmetry Triangle Generator Function/Preamp Power Amplifier/DC Offset Three Digit Attenuator	Function Generator (function generator calibration usually required when any function generator board is replaced)
-0509 -0500 -0501	Orange Red Brown	Digit 1/Mixer Digits 2 and 3 Digits 4 and 5/Reference	Synthesizer (Option 002)
-0647 -0493 -0494	White White White	Mircroprocessor (With Wavetek Bus Address Switch) Memory RAM Memory PROM (May Have: Stored Setting Option 003; Ampl Conversion Option 006)	Microprocessor
-0643 -0554	White NA	GPIB Interface GPIB Decoder	GPIB Interface (Option 005)
-0491 -0505	White NA	154/157 Emulator Interface Emulator Decoder	154/157 Emulator (Option 004)
-0616	NA	Front Panel	Front Panel (Option 001)

overloaded supply. Use an ohmmeter to find the board having a short circuit condition by measuring the impedance between the ground and the supply line. If this is not successful, do the following. (This procedure is not recommended for the +5V supply.)

1. Monitor the supply voltage with a voltmeter at the regulator board (-0633).

2. From table 5-2, locate all the PC boards related to the overloaded supply.

3. Remove one of the boards and turn on the generator just long enough to make a voltage reading from the voltmeter.

4. If the supply voltage was back to normal, the removed board was the defective board.

5. If supply voltage is not back to normal after all the PC boards have been tested, possibly the regulator board itself is defective.

5.3 FUNCTION GENERATOR

If the generator is malfunctioning, first check the power supply voltages (refer to paragraph 5.2). Because some problems are due to the system being out of calibration, calibrate the function generator before troubleshooting (refer to paragraph 6.3). Troubleshoot using table 5-3.

Table 5-2. Power Supply Distribution

	Power Supply	PC Board	Connector Pin (A & B Sides)
100 Pin Connector Group	+5V Com	-0493, -0494, -0643, -0647	49 - 52 1, 2, 99, 100
	−5V	-0493	53
	+5V Iso Gnd Iso	-0643	63, 78 62, 77
	+12V	-0493	3
50 Pin Connector Group	+5V Com	-0490, -0500, -0501, -0509, -0590, -0612, -0635, -0638	19, 20 22 - 24
	−5V	-0500, -0501, -0509	50
	+15V Com −15V	-0490, -0500, -0501, -0509, -0590, -0612, -0635	33, 34 26 - 28 30, 31
	+24V −24V	-0590	39, 40 36, 37
	+24V −24V	-0612	43 41
	+5V Gnd −12V −250V	Front Panel	J2 - 1, 2 J2 - 3, 4 J2 - 24 J1 - 26
	+5V Iso Gnd Iso	GPIB Decoder (-0554)	P17 - 20 P17 - 18, 19

Table 5-3. Function Generator Troubleshooting

NOTE: This information is for frequency problems apparent while the generator is in open loop, continuous mode.

Symptom	Further Observation	Probable Cause	Cure
1. Frequency accuracy out of spec. Problem has to do with the three digit setting.	1. Problem always happens at the same setting(s), between 1.00 and 9.99 of every frequency decade.	1. Frequency D/A converter. 2. Frequency data latch. 3. Internal bus.	Replace VCG board (-0612).
	2. All frequencies too high or too low. Waveform time symmetry normal.	1. VCG gain control. 2. Triangle peak voltage too high or too low.	Replace VCG board (-0612) or Triangle Generator board (-0635).
	3. Waveform time symmetry also out of spec.	Current generator.	Replace VCG board (-0612).
	4. Problem happens only at 1 to 13 MHz, or 100 kHz to 1 MHz. Also see Symptom 5.	Frequency compensation components.	Replace Triangle Generator board (-0635).
	5. Triangle waveform also distorted.	1. Frequency range switch. 2. Component connected to the triangle amplifier input.	Replace Triangle Generator board (-0635).
2. Frequency accuracy out of spec. Problem has to do with the range multiplier.	1. Out of spec at one particular frequency decade, but greater than 0.999 Hz.	1. Frequency range switches or capacitors. 2. Frequency range data latch or decoder.	Replace Triangle Generator board (-0635).

Table 5-3. Function Generator Troubleshooting (Continued)

Symptom	Further Observation	Probable Cause	Cure
	2. Less than 0.999 Hz.	1. Capacitance multiplier. 2. Frequency range data latch or decoder.	Replace Triangle Generator board (-0635).
3. Time symmetry out of spec.	1. Triangle waveform also non-linear.	1. Frequency range switches. 2. Component connected to the triangle amplifier input.	Replace Triangle Generator board (-0635).
	2. Triangle waveform linear.	1. Current generator. 2. Current mirror circuit.	Replace Triangle Generator board (-0635).
	3. Time symmetry problem only at frequency 0.999 Hz or less.	Capacitance multiplier circuit.	Replace Triangle Generator board (-0635).
4. Low frequency (< 100 kHz) sine distortion out of spec.	1. Time symmetry also out of spec.	See Symptom 3 for time symmetry problem.	Replace Triangle Generator board (-0635).
	2. Nonlinear triangle waveform.	See Symptom 1-5.	Replace Triangle Generator board (-0635).
	3. Triangle waveform appears to be good.	Sine converter circuit.	Replace Function/ Preamp board (-0490).
	4. All waveforms are badly distorted.	Preamp or power amplifier.	Replace Function/ Preamp board (-0490) or Power Ampl/Offset board (-0590).
5. High frequency (> 100 kHz) sine distortion out of spec.	1. Frequency accuracy out of spec at frequency > 1 MHz.	1. Current generator is saturated. 2. Current mirror circuit is saturated. 3. See Symptom 1-4.	Replace VCG board (-0612) or Triangle Generator board (-0635).
	2. Square wave has excess overshoot or slow rise time.	Preamp or power amplifier.	Replace Function/ Preamp board (-0490) or Power Ampl/Offset board (-0590).
	3. Square wave ok, but badly distorted triangle.	Triangle amplifier No. 1 or No. 2.	Replace Triangle Generator board (-0635).
	4. Otherwise.	Sine converter.	Replace Function/ Preamp board (-0490).

Table 5-3. Function Generator Troubleshooting (Continued)

Symptom	Further Observation	Probable Cause	Cure
6. Amplitude accuracy out of spec at 1 kHz.	1. All waveform amplitudes out of spec between 1V p-p and 15V p-p.	1. Three digit attenuator. 2. Internal bus.	Replace Attenuator board (-0638).
	2. Ratio is not correct when amplitude is ranging from 9.99, 0.999, 0.0999 to 0.00999V p-p.	1. Output attenuator. 2. Attenuator control logic. 3. Internal bus.	Replace Power Ampl/Offset board (-0590).
	3. Inverting output ("—" amplitude) ok, but not normal output ("+" amplitude).	1. Noninverting amplifier. 2. Relay.	Replace Function/ Preamp board (-0490).
	4. Square wave amplitude out of spec.	Square wave shaper circuit.	Replace Function/ Preamp board (-0490).
	5. Triangle wave amplitude out of spec.	Gain control resistors.	Replace Function/ Preamp board (-0490).
	6. Excess amplitude roll off at high frequency.	1. Frequency compensation components. 2. Frequency compensation components in power amplifier.	Replace Function/ Preamp board (-0490). Replace Power Ampl/Offset board (-0590).
7. DC offset problem.		1. DC offset circuit. 2. Offset control logic. 3. Internal bus.	Replace Power Ampl/Offset board (-0590).
8. Trigger and gate problem.		Trigger logic and trigger amplifier.	Replace Triangle Generator board (-0635).
9. No waveform output at 50Ω OUT.	1. Voltage at 50Ω OUT is saturated to maximum positive or negative. SYNC OUT is normal.	1. Power amplifier. 2. Function/preamp.	Replace Power Ampl/Offset board (-0590). Replace Function/ Preamp board (-0490).
	2. SYNC OUT is normal and dc voltage at 50Ω OUT is normal when dc voltage is selected.	Waveform switching relay and control logic.	Replace Function/ Preamp board (-0490).
	3. No SYNC OUT when continuous mode is selected.	1. Triangle generator loop. 2. Current mirror circuit. 3. Current generator.	Replace Triangle Generator board (-0635). Replace VCG board (-0612).

Table 5-3. Function Generator Troubleshooting (Continued)

Symptom	Further Observation	Probable Cause	Cure
	4. Generator runs if diode CR15 in subassy -0558 of -0635 is removed.	1. Trigger circuit. 2. GEN MODE control logic.	Replace Triangle Generator board (-0635).
10. Output waveform is not the waveform programmed.	No other programming error.	1. Function selecting relay. 2. Function control logic. 3. Internal bus.	Replace Function/ Preamp board (-0490).
11. Generator frequency does not lock to external frequency.	1. Phase not locked at all frequencies.	1. Generator frequency is not within ±2% of external frequency. 2. Phase detector or filter. 3. Input circuit.	Change the generator frequency. Replace VCG board (-0612).
	2. No phase lock at a frequency range.	Loop filter selection circuit.	Replace VCG board (-0612).

5.4 INTERNAL DATA BUS

All the internal programming data sent to the function generator and the frequency synthesizer sections are sent in multiplex fashion through the 14 internal bus lines. It takes only one defective bus receiver, 74LS139 or 74LS175, to hang up an entire line. A defective receiver can cause incorrect generator responses everywhere.

When the bus is not sending data, no EXECUTE command, the voltage at each bus is biased to approximately +3 volts. If the bus voltage is greater than +4 volts, or less than +2 volts, there is a defective bus receiver or driver on the line. The defective component can be located by removing one board at a time. The bus voltage will be back to normal when the defective board is removed. Table 5-4 gives the bus location.

5.5 SYNTHESIZER

When the 172A output frequency is incorrect in the synthesizer mode, the problem may be on one of the three synthesizer boards, or, it may be in the function generator section. The following checks in table 5-5 can be made external to the 172A with a frequency counter.

NOTE

Tests in the synthesizer mode are done on the 1 to 13 MHz range for two reasons. The natural output of the synthesizer is 1 to 13 MHz, so there is less chance of confusion; and the frequency counter will give high resolution readings with a minimum gate time on this range.

Table 5-4. Internal Data Bus Location

Description	Bus Line	Pin No.*
Strobe	STRB	1
Data Group	A3	2
	A2	3
	A1	4
	A0	5
Sign	S	6
Data Byte	D7	7
	D6	8
	D5	9
	D4	10
	D3	11
	D2	12
	D1	13
	D0	14

*PC-to-Mother board connector (Function Generator or Synthesizer boards).

NOTE

Table 4-2 describes the data content of each line on the internal data bus.

Table 5-5. Synthesizer Troubleshooting

Symptom	Discussion
1. The function generator output frequency is correct on the 1 to 12.9999 MHz range, but is not correct on one or more lower ranges.	1. This indicates the synthesizer subassembly is functioning properly, and the problem is on the VCG board (-0612) where the main function generator is phase locked to the synthesizer output. 2. When a particular range and all lower ranges do not work, and all higher ranges do work, the problem is in the decade digital divider string on the VCG board (-0612).
2. The output frequency is wrong on the 1 to 12.9999 MHz range, but one or more of the lower ranges works.	Check the open loop frequency (continuous mode, B0). If this frequency is greater than 4% from the programmed frequency, the function generator frequency may be outside the capture range of the function generator phase lock loop (PLL). (Refer to paragraph 5.3.)
3. There is no change in frequency switching between continuous (B0) and synthesized (B3) modes.	The VCG board is not receiving the digital command to switch into the synthesized mode. Check the front panel to make sure the display is not indicating a programming error. If there is no programming error, refer to Internal Data Bus, paragraph 5.4. Frequency must be greater than 10 Hz.
4. The 172A does not operate properly in synthesized mode, but does in external phase lock (B6) mode (with the proper external signal provided).	The main generator phase lock circuitry is operating properly and the problem is likely to be in the synthesizer section. See Symptom 6. A good frequency source for the external phase lock check is the 10 MHz reference output available on the rear panel of the 172A. A different frequency such as 1 MHz may be available from the frequency counter used for testing.
5. The synthesized frequency is off by a small, constant percentage error at all frequencies.	The error is in the synthesizer time base, which is an adjustment located on the Digits 4 and 5/Reference PC board (-0501); adjust or replace the board.
6. There is a failure within the synthesizer.	1. An indication of the specific failure location can be obtained by a careful study of the actual output frequencies for a range of input frequencies. For example: Programmed frequencies from 1.0000 MHz to 1.0067 MHz work properly. Programmed frequencies from 1.0068 MHz to 1.0099 MHz give an output frequency of 1.0067. This pattern then repeats: 1.0100 thru 1.0167 work properly and 1.0168 thru 1.0199 give an output of 1.0167 MHz. This pattern also repeats at any other frequency: the first three digits work properly and the fourth and fifth digit work properly when programmed between 00 and 67. Armed with these data, and a knowledge of the synthesizer structure (refer to the synthesizer block diagrams in section 4), you may deduce the problem lies within the digits 4 and 5 PLL located on the digits 4 and 5/ Reference PC board, or the translation loop located on the digits 2 and 3 translation loop PC board. With these particular symptoms, it is likely the Voltage Controlled Oscillator (VCO) frequency has shifted in the translation loop or digits 4 and 5 loop, and can be corrected with a simple calibration adjustment. Determining which of the two possible loops are bad requires going inside the 172A and measuring the actual output of digits 4 and 5. If spare boards are available, substitution will reveal which of the two is defective faster than making on board measurements.

Table 5-5. Synthesizer Troubleshooting (Continued)

Symptom	Discussion
6. There is a failure within the synthesizer. (continued)	2. Another example: All programmed frequencies from 1.0000 thru 1.0099 MHz measure 1.0154 MHz; all programmed frequencies from 1.0100 thru 1.0199 measure 1.0254 MHz; all programmed frequencies from 1.0200 thru 1.0299 MHz measure 1.0354 MHz, etc. Again, the indications are that the digit 2, 3 loop and all following stages are operating correctly because the synthesizer follows each 10 kHz change in programmed frequency even though the output frequency is not correct. The digit 4, 5 loop or the translation loop is functioning incorrectly and outputting a single frequency instead of following the programming changes. Again with these symptoms, one of the two loops may have a defective component or the oscillator natural frequency may have shifted more than the loop can correct for, and repair consists of a simple calibration adjustment. Refer to the synthesizer calibration procedure.

5.6 MICROPROCESSOR

When microprocessor problems are suspected, always check the +5, −5 and +12V power supplies (refer to paragraph 5.2). If all voltages are present, use table 5-6 to troubleshoot. Replace board assemblies one at a time, until the problem is eliminated.

5.7 GPIB INTERFACE

Because the 172A has more than one programming channel (GPIB, front panel and Wavetek bus) it is relatively easy to isolate interface problems. (Refer to table 5-7.)

5.8 FRONT PANEL

The front panel assembly contains circuitry for two distinct functions; display and keyboard, both communicating with the microprocessor through the data and address busses. Because of the intimate relationship of the front panel and microprocessor, it can be difficult to isolate a problem to a particular area. (Refer to table 5-8 for troubleshooting hints.)

Table 5-6. Microprocessor Troubleshooting

Symptom	Possible Cure
1. 172A will not power up.	1. Replace PROM board (-0494). 2. Replace RAM board (-0493). 3. Replace Microprocessor board (-0647).
2. 172A powers up, but gives ERROR when key is pressed.	1. Replace RAM board (-0493). 2. Replace PROM board (-0494). 3. Replace Microprocessor board (-0647).
3. 172A powers up with ERROR in left margin.	1. Replace PROM board (-0494). 2. Replace Microprocessor board (-0647). 3. Replace RAM board (-0493).
4. 172A powers up and reads different GPIB address other than the setting.	1. Check the isolated +5V (refer to paragraph 5.2). 2. Replace GPIB Interface board (-0643).
5. 172A will not talk or listen on GPIB.	1. Correct the listen address setting on rear panel. 2. Check the isolated +5V (refer to paragraph 5.2). 3. Replace GPIB Interface board (-0643).
6. While running, 172A resets itself and displays "WAVETEK MODEL 172A".	1. Replace Microprocessor board (-0647). 2. Replace PROM board (-0494). 3. Replace RAM board (-0493).

Table 5-7. GPIB Interface Troubleshooting

Symptom	Discussion
1. When addressed as a listener or talker, the 172A does not display an L or T on the right-hand corner of the display.	Find the GPIB listen and talk addresses by pushing the ADR key. They will be displayed. Program the controller to send the listen address. (The HP 9825 controller message is wrt 7xx, where xx is the 172A address.) L, or RL, should appear on the right-hand corner of the display; if not, the malfunction is in the GPIB Interface board (-0643). The talk address problem is similarly dealt with.
2. Displayed parameter values differ from GPIB programmed values.	Use the CMD RCL key to display the programming received by the post-interface circuits. If this differs from GPIB programmed values, duplicate the programming by using the front panel controls. Correct display isolates the malfunction to the GPIB Interface board (-0643).

Table 5-8. Front Panel Troubleshooting

CAUTION: There is high voltage (−250 Volts) present in the front panel.

Symptom	Discussion
1. When power is first turned on, the front panel readout displays a random group of characters. After a short delay, the microprocessor commands the front panel to display "WAVETEK 172A". The message is not displayed.	If this message never appears, the problem can be on any of the digital boards. Most likely it is not a front panel problem. While a front panel failure could cause the front panel to not accept data, it is much more likely the microprocessor never reached the portion of the operating program that causes the initial display. Replace the Microprocessor boards (-0647, -0493, -0494) one at a time. Test the 172A with each replacement.
2. After the turn-on delay, the initial random characters are replaced by another meaningless display.	The microprocessor is reaching the front panel. Examine this message carefully for clues as to the possible problem; for example, "V@VDTDJ062@" instead of "WAVETEK 172A" would indicate the "1" bit of the data word was hung in a false condition. This could be occurring in the front panel bus receivers, memory or in the display component itself. Another type of failure mode might be "WAWATETE1717" indicating a hung "2" bit on the address lines driving the memory IC. In any case, the malfunction is most likely in the front panel.
3. The display is missing portions of characters or characters are jittering in position.	The problem is most likely the display component, although the −250V regulator could be causing the flicker. Replace the front panel.

Table 5-8. Front Panel Troubleshooting (Continued)

CAUTION: There is high voltage (−250 Volts) present in the front panel.

Symptom	Discussion
4. The keyboard "beeps" normally when a key is depressed, but the processor ignores it (no response on the display).	The problem may be in the front panel or in the microprocessor. Command the 172A via the GPIB or other interface, if available, or through the Wavetek bus and check for proper operation. If the 172A cannot be commanded by any means, the problem is most likely not in the front panel. A front panel address or data bus driver or receiver could fail in a manner to permanently hang a bus line, preventing the microprocessor from operating properly. Unplug the front panel from the mother board (J20), with power off. Turn power back on and again try to command the 172A via GPIB or other interface. If the 172A runs properly, the problem is in the front panel.
5. The keyboard fails to "beep", but commands the 172A properly.	The problem is in the circuitry associated with the audio sounder. Replace the front panel.
6. The keyboard neither beeps or commands the 172A, but 172A works properly with another interface.	The problem is with the keyboard encoder, or the keyboard membrane switch itself. Replace the front panel.

SECTION 6
CALIBRATION

6.1 INTRODUCTION

The following four calibration procedures may be used to totally align the 172A periodically, or they may be used individually to calibrate the functional group to which they apply. Individual procedures would be used in the case of a circuit board replacement or for out-of-spec operation of a particular functional group.

The functional groups are shown in table 5-1 with a listing and location of individual assemblies within the groups. The microprocessor group, the emulator group and the GPIB group require no calibration. The calibration procedures included herein are:

Group	Board No.	Paragraph
Power Supply	-0633	6.2
Function Generator	-0490, -0590, -0612, -0635	6.3
Synthesizer	-0500, -0501, -0509	6.4
Front Panel	-0626	6.5

Periodic calibration of all groups is needed because of component aging, which depends on the instrument on-time and environment. Use three months as an initial calibration period. If possible, keep records of parameter values and increase the time between calibrations as the records indicate.

6.2 POWER SUPPLY CALIBRATION

Use a Dana 5900 DVM or equivalent to make the following adjustments to board -0633.

1. Connect DVM between TP7 and TP6 and adjust R24 for 15.0 Vdc ±20 mV.

2. Connect DVM between TP3 and TP5 and adjust R10 for 24 Vdc ±200 mV.

3. Connect DVM between TP15 and TP12 and adjust R58 for 5 Vdc ±0.1V.

6.3 FUNCTION GENERATOR CALIBRATION

Use the test equipment listed here, or equivalent, to perform the procedures given in table 6-1.

1. Frequency Counter: Dana Model 8110

2. DVM: Dana 5900

3. Distortion Analyzer: HP Model 334A

4. Oscilloscope: Tektronix Model 7904 with

   a. Dual Trace Amplifier 7A26
   b. Dual Time Base 7B92
   c. Differential Comparator 7A13

5. 50 ohm 5W Termination: Tektronix 011-0099-00

6. Scope Probe: Tektronix P6101

7. Probe Tip BNC Adapter: Tektronix 013-0034-02

6.4 SYNTHESIZER CALIBRATION

Use the test equipment listed here, or equivalent, to perform the procedures given in table 6-2.

Frequency Counter: Dana 8110
RF Millivoltmeter: Boonton 92C
DVM: Dana 5900
172A Extender Board: Wavetek

6.5 FRONT PANEL CALIBRATION

1. Repeatedly press any front panel switch to obtain an audio tone.

2. Adjust R15 on the front panel PC board for the greatest volume.

CAUTION

There are exposed high voltage points (250 volts) in the display section.

Table 6-1. Function Generator Calibration Procedures

Step	Check	Tester	Cal Points	Program	Adjust	Desired Results	Remarks
1	Trigger Baseline	DVM in dc Mode	TP1 (-0490)	FREQ: 9.99E2 FUNC: 2 OUTP: 1 MODE: 1 AMPL: −10	R54 (-0635)	0V ±10 mVdc	999 Hz, inverted, 10V p-p ⊓⊔, trig mode.
2	Positive Triangle Peak	Scope With Comparator		FUNC: 4 MODE: 0	R79 (-0635)	+2V ±10 mVp	dc, cont mode.
3	Negative Triangle Peak				R76 (-0635)	−2V ±10 mVp	
4	Symmetry Zero	DVM in dc Mode	TP2 (-0635)		R124 (-0635)	0V ±1 mVdc	
5	Inverted Zero		TP3 (-0490)		R53 (-0490)	0V ±2 mVdc	
6	Standard Zero		TP2 (-0490)		R79 (-0490)	0V ±2 mVdc	
7	Offset Standard Zero		TP2 (-0590)		R72 (-0590)	0V ±5 mVdc	
8	Offset Inverted Zero		TP4 (-0590)		R75 (-0590)		
9	Power Amplifier Zero		50Ω OUT (Rear Panel)		R53 (-0590)	0V ±1 mVdc	
10	1000:1 Symmetry	2 CH Scope With 50Ω Load, Counter		FUNC: 2 OUTP: 0 FREQ: 1E4 FREQ: 0 R28 (-0612): ccw	R58, 75 (-0612)	5 ±0.5 ms on each ½ cycle (100 ±10 Hz)	⊓⊔, no internal load (load at scope), 10 kHz range, 0 Hz; R58 and 75 settings must be done in sequence.
11	Bottom Frequency			FREQ: 1E2	R28 (-0612)	100 ±1 Hz	
12	Bottom Symmetry				R33 (-0612)	Symmetry ±0.1% (10 μs)	
13	High Freq Symmetry			FREQ: 1E5	R72 (-0612)	Symmetry ±0.3% (30 ms)	
14	Top Frequency			FREQ: 9.99E2	R21 (-0612)	999 ±5 Hz	
15	Top Symmetry				R67 (-0612)	Symmetry ±0.1% (1 μs)	Repeat steps 11 - 15 until all settings are in tolerance.

Table 6-1. Function Generator Calibration Procedures (Continued)

Step	Check	Tester	Cal Points	Program	Adjust	Desired Results	Remarks
16	HF ⊓⊔ Abberations	2 CH Scope With 50Ω Load	50Ω OUT	FREQ: 1E6	C12 (-0590)	Best ⊓⊔	
17	Frequency	Counter		FREQ: 12.99E6	C41 (-0635)	12.99 MHz ±50kHz	Check over 1-12.99 range and distribute the error.
18				FREQ: 9.99E4	C44 (-0635)	99.9 kHz ±500 Hz	
19				FREQ: 9.99E5	R22 (-0612)	999 ±5 kHz	
20				FREQ: 9.99E3	R20 (-0612)	9.99 kHz ±50 Hz	
21				FREQ: 9.99E1	R18 (-0612)	0.01001s ±50 μs (50 μs)	
22				FREQ: 9.99	R17 (-0612)	0.1001s ±0.5 ms (0.5 ms)	
23				FREQ: 9.99E-1	R120 (-0635)	1.001s ±5 ms (5 ms)	
24	Sine Distortion	Scope With Comparator & Distortion Analyzer; Load Removed		FREQ: 9.99E2 FUNC: 0 OUTP: 1	R11 (-0490)	+5V ±20 mVdc at positive peak	Internal load, 999 Hz ∿ output.
25					R9 (-0490)	−5V ±20 mVdc at negative peak	
26					R107 (-0490)	Symmetrical residue	Connect scope to distortion analyzer output.
27					R1 (-0490)	Minimum distortion (0.15% typ)	After this step, repeat steps 23 thru 26 once.
28	Negative Sine Unity Gain	DVM in ac Mode			R45 (-0590)	3.535V ±3 mVrms	
29	Positive Sine Unity Gain			AMPL: 10	R95 (-0490)	3.353V ±3 mVrms	
30	−DC Offset Gain	DVM in dc Mode		FUNC: 4 OFST: −7.49	R62 (-0590)	−7.49V ±20 mVdc	−7.49 Vdc output.
31				OFST: 7.49		+7.49V ±40 mVdc	Verify.

Table 6-1. Function Generator Calibration Procedures (Continued)

Step	Check	Tester	Cal Points	Program	Adjust	Desired Results	Remarks
32	Haver Baseline	DVM in dc Mode	50Ω OUT	FUNC: 1 OFST: 0 MODE: 5	R37 (-0635)	−5V ±50 mVdc	Gated havertriangle output.
33	∿ Gain	Scope With Comparator		AMPL: −10 MODE: 0	R5 (-0490)	+5 Vp ±20 mV	Continuous inverted havertriangle output.
34						−5 Vp ±20 mV	Verify negative peak of ∿.
35	⊓⊔ Positive Peak			FUNC: 2	R36 (-0490)	+5 Vp ±10 mV	⊓⊔ output.
36	⊓⊔ Negative Peak				R43 (-0490)	−5 Vp ±10 mV	

Table 6-2. Synthesizer Calibration

Step	Check	Tester	Cal Points	Program	Adjust	Desired Results	Remarks
1	Time Base	Counter	REF OUT (Rear Panel)		L2 (-0501)	10.00000 MHz	
2	30 MHz Multiplier	RF Millivoltmeter	TP3 (-0501)		L3 (-0501 30 MHz MULT)	Maximum Reading	Place (-0501) on the extender board. Remove shield. Connect probe gnd lead to board common as near TP3 as possible.
3	60 MHz Multiplier		TP4		L4 (-0501 60 MHz MULT)	Maximum Reading	
4	Digits 4, 5 VCO	DVM	Junction CR1/C3	FREQ 10.9999E6	L1 (-0501 40 MHz VCO)	1.70 Vdc	Connect DVM gnd to board common.

Table 6-2. Synthesizer Calibration (Continued)

Step	Check	Tester	Cal Points	Program	Adjust	Desired Results	Remarks
5	Translation Loop VCO	DVM	Terminal VC on 60.4 MHz Module	FREQ 10.9999E6	C1	1.30 Vdc	Replace -0501 and place -0500 on the extender board. Connect DVM gnd to 60.4 MHz module common. C1 is the trimmer capacitor protruding from the underside of 60.4 MHz module.
6	Digits 2, 3 VCO		Terminal VC on 40 MHz Module (-0500)		L1	3.50 Vdc	Connect DVM gnd to 40 MHz module case. L1 is accessible thru a hole in top of 40 MHz module.
7	Digit 1 VCO		Pin Vc on 35 MHz Module A1 (-0509)	FREQ: 1.0000E6	L1	3.46 Vdc	Replace -0500 and place -0509 on the extender board. L1 is accessible thru a hole in top of 35 MHz module.
8	Output Mixer	RF Millivoltmeter	TP2	FREQ: 5.8500E6	L7 (30 MHz BPF)	Maximum Reading.	
9			TP3		L11, 12 (Input Mixer)		
10			TP4		L13, 14 (34.5 MHz BPF)		After this step, reinstall -0509 board.

SECTION 7
PARTS AND SCHEMATICS

7.1 DRAWINGS

The following assembly drawings, parts lists and schematics are in the arrangement shown below.

7.2 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, board, serial number of unit and the function performed.

Drawing	Drawing No.
CHASSIS	
Chassis Assembly	1102-00-0623
Chassis Parts List	1101-00-0623
Rack Slide, Option 007 Assembly	0102-00-0639
Rack Slide, Option 007 Parts List	1101-00-0639
Front Panel Assembly	0102-00-0616
Front Panel Parts List	1101-00-0616
Rear Panel Schematic	0104-00-0614
Rear Panel Assembly	0102-00-0614
Rear Panel Parts List	1101-00-0614
Cable Interconnect	1207-00-0650
GPIB Decoder Schematic	0103-00-0554
GPIB Decoder Assembly	0101-00-0554
GPIB Decoder Parts List	1100-00-0554
Mother Board Assembly	0101-00-0651
Mother Board Parts List	1100-00-0651
Signal Routing on Mother Board	
MAJOR PC BOARDS	
Pass Transistor/Regulator Schematic	0103-00-0634
Pass Transistor/Regulator Assembly	0101-00-0634
Pass Transistor/Regulator Parts List	1100-00-0634

7.3 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the cover.

Drawing	Drawing No.
Power Supply Regulator Schematic	0103-00-0633
Power Supply Regulator Assembly	0101-00-0633
Power Supply Regulator Parts List	1100-00-0633
Memory PROM Schematic	0103-00-0494
Memory PROM Assembly	0101-00-0494
Memory PROM Parts List	1100-00-0494
PROM Package, Parts List	1109-00-0008
PROM Package, Option 003 Parts List	1109-00-0012
PROM Package, Option 006 Parts List	1109-00-0013
Memory RAM Schematic	0103-00-0493
Memory RAM Assembly	0101-00-0493
Memory RAM Parts List	1100-00-0493
Microprocessor Schematic	0103-00-0647
Microprocessor Assembly	0101-00-0647
Microprocessor Parts List	1100-00-0647
GPIB Interface Schematic	0103-00-0643
GPIB Interface Assembly	0101-00-0643
GPIB Interface Parts List	1100-00-0643
Power Amplifier/DC Offset Schematic	0103-00-0590
Power Amplifier/DC Offset Assembly	0101-00-0590
Power Amplifier/DC Offset Parts List	1100-00-0590
Power Ampl Subassembly No. 1 Assembly	0101-00-0591
Power Ampl Subassembly No. 1 Parts List	1208-00-0591

Drawing	Drawing No.
Power Ampl Subassembly No. 2 Assembly	0101-00-0592
Power Ampl Subassembly No. 2 Parts List	1208-00-0592
Power Ampl Subassembly No. 3 Assembly	0101-00-0593
Power Ampl Subassembly No. 3 Parts List	1208-00-0593
3 Digit Attenuator Schematic	0103-00-0638
3 Digit Attenuator Assembly	0101-00-0638
3 Digit Attenuator Parts List	1100-00-0638
Function/Preamp Schematic	0103-00-0490
Function/Preamp Assembly	0101-00-0490
Function/Preamp Parts List	1100-00-0490
Triangle Generator Schematic	0103-00-0635
Triangle Generator Assembly	0101-00-0635
Triangle Generator Parts List	1100-00-0635
Hysteresis Switch, Triangle Generator Assembly	0101-00-0558
Hysteresis Switch, Triangle Generator Parts List	1208-00-0558
Trigger, Triangle Generator Assembly	0101-00-0559
Trigger, Triangle Generator Parts List	1208-00-0559
Buffer Ampl, Triangle Generator Assembly	0101-00-0560
Buffer Ampl, Triangle Generator Parts List	1208-00-0560
VCG and Symmetry Schematic	0103-00-0612
VCG and Symmetry Assembly	0101-00-0612
VCG and Symmetry Parts List	1100-00-0612

Drawing	Drawing No.
Digit 1/Mixer Schematic	0103-00-0509
Digit 1/Mixer Assembly	0101-00-0509
Digit 1/Mixer Parts List	1100-00-0509
35/40 MHz VCO Module, Digit 1/Mixer Schematic	0104-00-0519
35/40 MHz VCO Module, Digit 1/Mixer Assembly	0102-00-0519
35/40 MHz VCO Module, Digit 1/Mixer Parts List	1206-00-0519
Digits 2 & 3 Schematic	0103-00-0500
Digits 2 & 3 Assembly	0101-00-0500
Digits 2 & 3 Parts List	1100-00-0500
60.4 MHz VCO Module, Digits 2 & 3 Schematic	0103-00-0520
60.4 MHz VCO Module, Digits 2 & 3 Assembly	0102-00-0520
60.4 MHz VCO Module, Digits 2 & 3 Parts List	1206-00-0520
Digits 4 & 5/Reference Schematic	0103-00-0501
Digits 4 & 5/Reference Assembly	0101-00-0501
Digits 4 & 5/Reference Parts List	1100-00-0501

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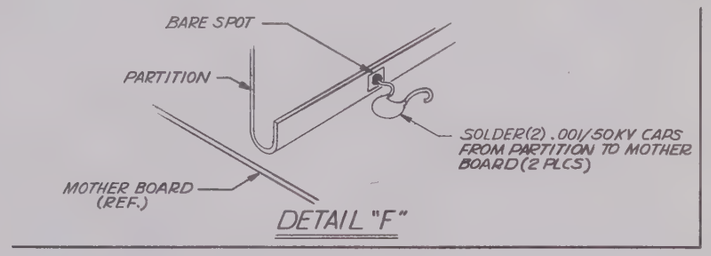
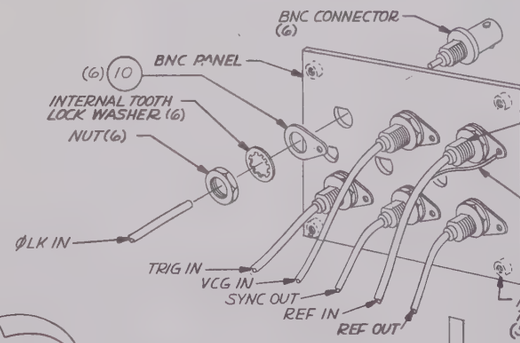
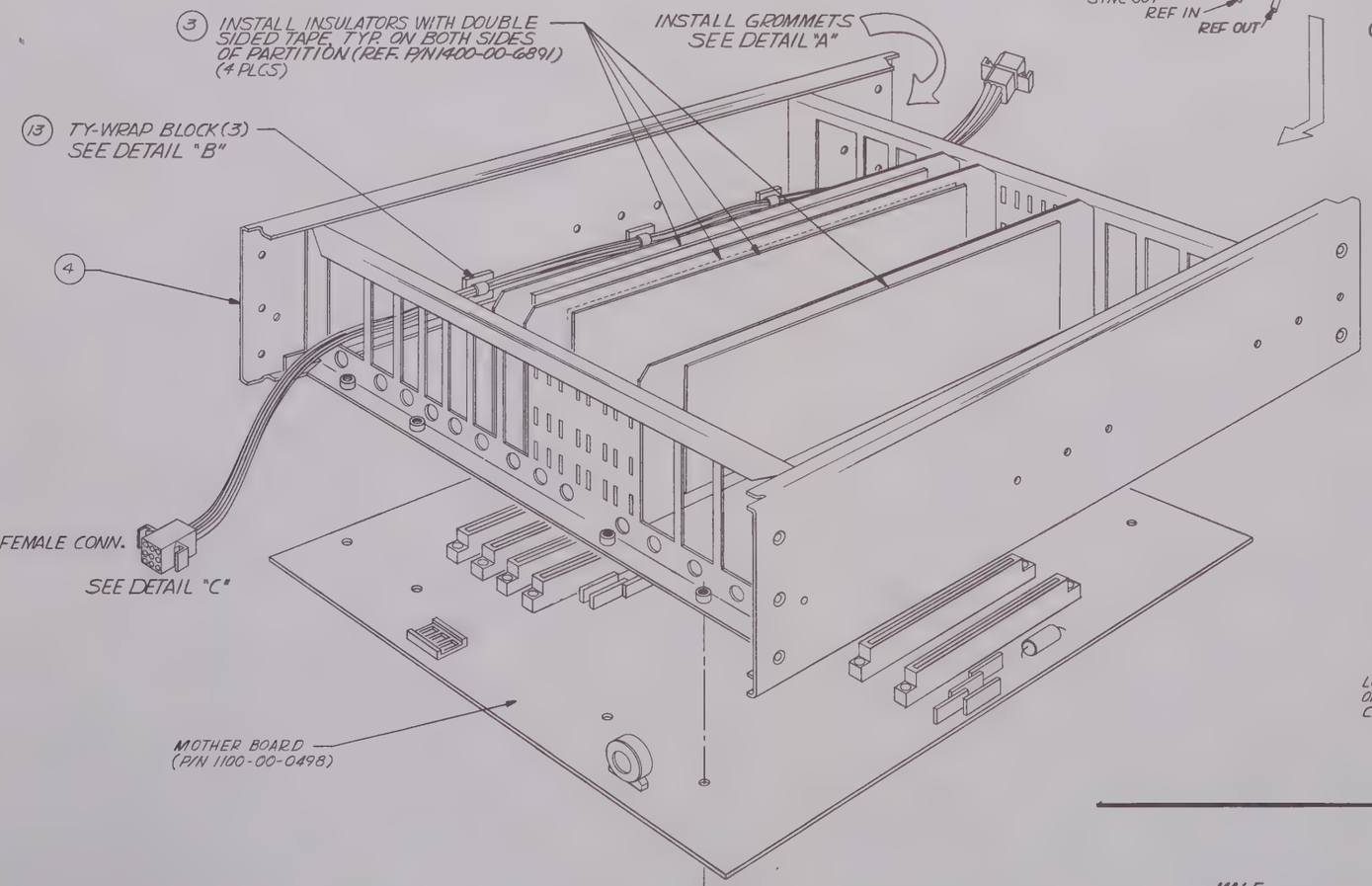
REV	ECN	BY	DATE	APP

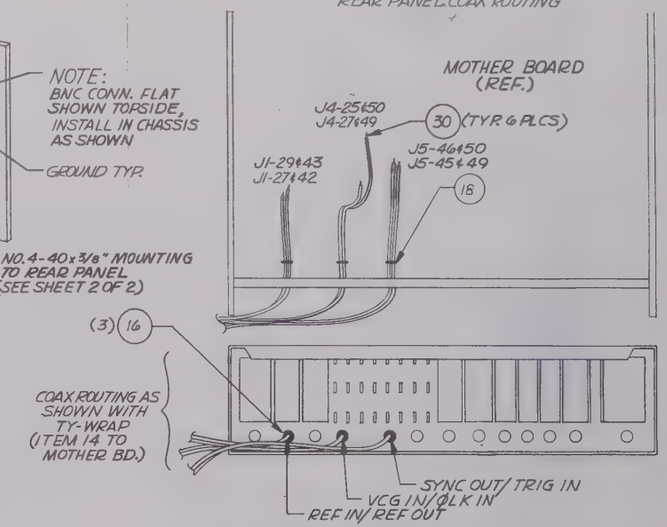


DETAIL "F"



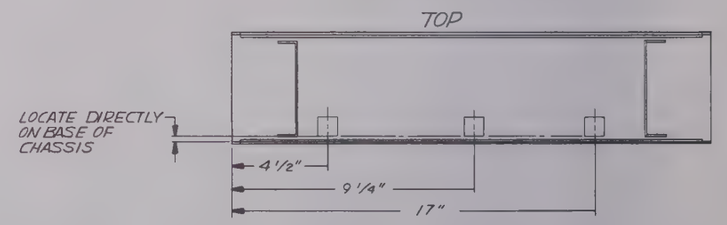

3 INSTALL INSULATORS WITH DOUBLE SIDED TAPE, TYP. ON BOTH SIDES OF PARTITION (REF. P/N 1400-00-6891) (4 PLCS)
INSTALL GROMMETS SEE DETAIL "A"
13 TY-WRAP BLOCK (3) SEE DETAIL "B"
4
FEMALE CONN. SEE DETAIL "C"
MOTHER BOARD (P/N 1100-00-0498)
NO. 4-40 x 1/4" PAN HEAD SCREW WITH INTERNAL TOOTH LOCK WASHER (8)
BE SURE .001 CAP. TERMINALS ARE AWAY FROM CHASSIS PARTITIONS BEFORE TIGHTENING
REF: DETAIL "F"

DETAIL "A"
REAR PANEL COAX ROUTING

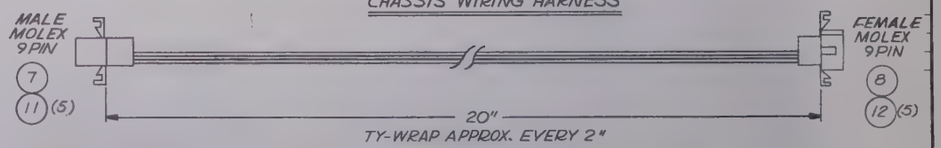


FUNCTION	COAX	SHIELD	COLOR	LENGTH (IN)
REF. IN	J1-29	J1-27	GRN	14"
REF. OUT	J1-43	J1-42	GRN/WHT	13"
VCG IN	J4-25	J4-27	RED/WHT	24"
ØLK IN	J4-50	J4-49	BLK	15½"
SYNC OUT	J5-46	J5-45	BLU/WHT	17"
TRIG IN	J5-50	J5-49	BLU	17½"

DETAIL "B"
TY-WRAP BLOCK LOCATION



DETAIL "C"
CHASSIS WIRING HARNESS



HARNESS WIRING POINT-TO-POINT

PIN #	COLOR	GA.
1	BRN/WHT	22
2	BLU	22
3	BRN	22
6	BLU/WHT	22
7	YEL/GRN	18
PINS 5,4,8,&9 NOT USED		

NOTE. UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 7-25-7	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Sal	SEPT 5-7	TITLE ASSEMBLY CHASSIS
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A · DWG NO 0102-00-0623 · REV A
	SCALE		CODE IDENT 23338 · SHEET 1 OF 2

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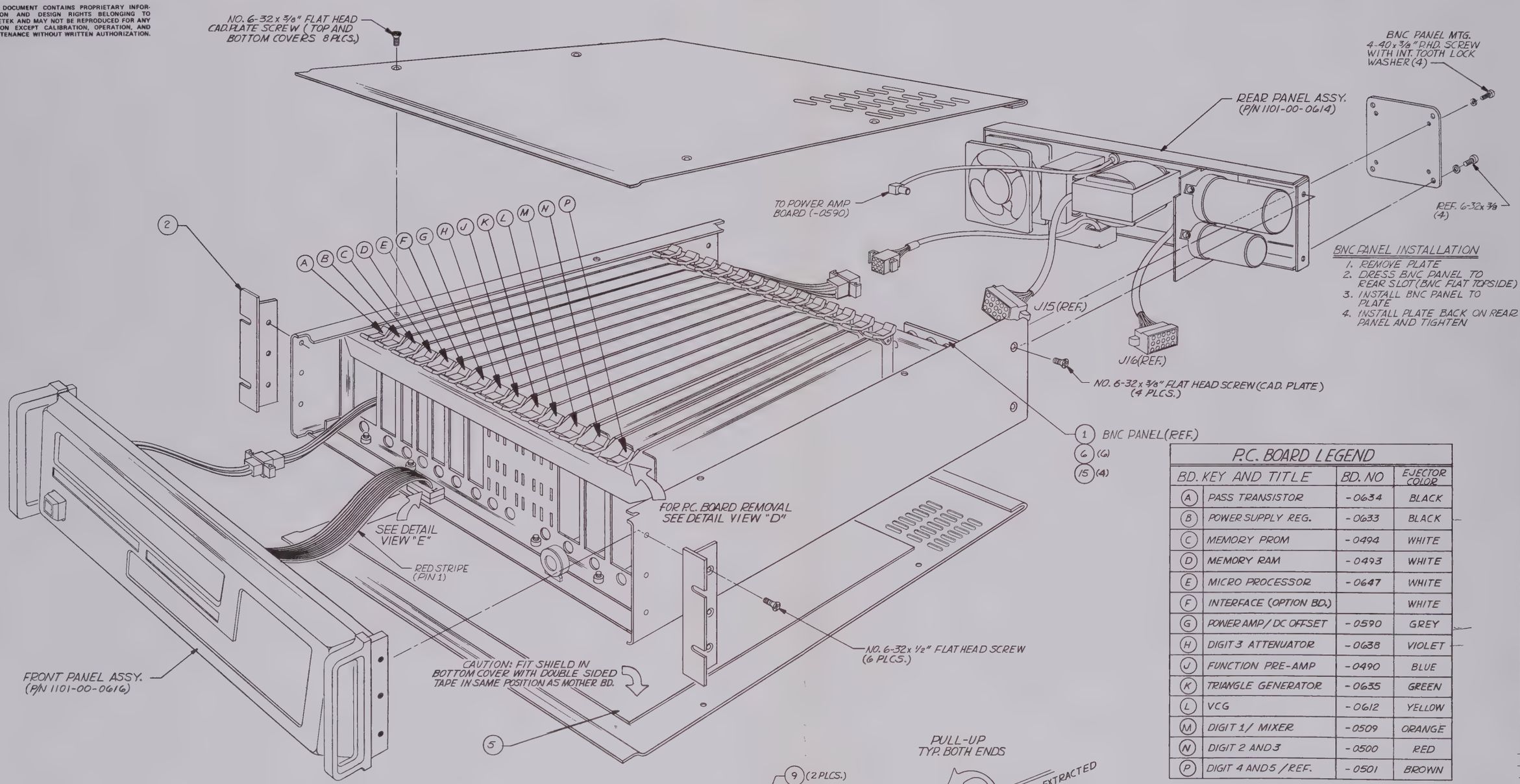
REV	ECN	BY	DATE	APP


NO. 6-32 x 3/8" FLAT HEAD CAD. PLATE SCREW (TOP AND BOTTOM COVERS 8 PLCS.)
BNC PANEL MTG. 4-40 x 3/8" PHD. SCREW WITH INT. TOOTH LOCK WASHER (4)
REAR PANEL ASSY. (P/N 1101-00-0614)
REF. 6-32 x 3/8 (4)
TO POWER AMP BOARD (-0590)
J15 (REF.)
J16 (REF.)
NO. 6-32 x 3/8" FLAT HEAD SCREW (CAD. PLATE) (4 PLCS.)
BNC PANEL (REF.)
(6) (6)
(15) (4)
FOR P.C. BOARD REMOVAL SEE DETAIL VIEW "D"
SEE DETAIL VIEW "E"
RED STRIPE (PIN 1)
NO. 6-32 x 1/2" FLAT HEAD SCREW (6 PLCS.)
FRONT PANEL ASSY. (P/N 1101-00-0616)
CAUTION: FIT SHIELD IN BOTTOM COVER WITH DOUBLE SIDED TAPE IN SAME POSITION AS MOTHER BD.
(5)
(9) (2 PLCS.)
MOTHER BOARD (REF.)
PULL-UP TYP. BOTH ENDS
P.C. BD. EXTRACTED
P.C. BD. INSTALLED
CHASSIS EDGE (REF.)

BNC PANEL INSTALLATION

1. REMOVE PLATE
2. DRESS BNC PANEL TO REAR SLOT (BNC FLAT TOPSIDE)
3. INSTALL BNC PANEL TO PLATE
4. INSTALL PLATE BACK ON REAR PANEL AND TIGHTEN

P.C. BOARD LEGEND

BD. KEY	AND TITLE	BD. NO	EJECTOR COLOR
(A)	PASS TRANSISTOR	-0634	BLACK
(B)	POWER SUPPLY REG.	-0633	BLACK
(C)	MEMORY PROM	-0494	WHITE
(D)	MEMORY RAM	-0493	WHITE
(E)	MICRO PROCESSOR	-0647	WHITE
(F)	INTERFACE (OPTION BD.)		WHITE
(G)	POWER AMP/DC OFFSET	-0590	GREY
(H)	DIGIT 3 ATTENUATOR	-0638	VIOLET
(J)	FUNCTION PRE-AMP	-0490	BLUE
(K)	TRIANGLE GENERATOR	-0635	GREEN
(L)	VCG	-0612	YELLOW
(M)	DIGIT 1/ MIXER	-0509	ORANGE
(N)	DIGIT 2 AND 3	-0500	RED
(P)	DIGIT 4 AND 5 / REF.	-0501	BROWN

DETAIL "E"
CONN HOLD DOWN

DETAIL "D"
TYP. P.C. BD. REMOVAL

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 7-25-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga	SEPT 8'77	TITLE ASSEMBLY CHASSIS
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ±1° .XX ± .030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 0102-00-0623 / REV A
	SCALE		CODE IDENT 23338 / SHEET 2 OF 2

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND DESIGN RIGHTS BELONGING TO WAVETEK AND MAY NOT BE REPRODUCED FOR ANY REASON EXCEPT CALIBRATION, OPERATION, AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION.

REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG CHASSIS	0102-00-0623	WVTK	0102-00-0623	1
1	BNC BD	1400-00-6021	WVTK	1400-00-6021	1
2	MTG.BKT	1400-00-6332	WVTK	1400-00-6332	2
3	INSULATOR REF:3200-03-0001	1400-00-6891	WVTK	1400-00-6891	4
4	CHASSIS	115-1575	CALMK	1400-00-7770	1
5	INSULATOR,BOTT	1400-00-7830	WVTK	1400-00-7830	1
29	LABEL,BD LOCATION	1400-00-8290	WVTK	1400-00-8290	1
NONE	CAP,CER,.001MF,3KV	DD30-102	CWL	1500-01-0205	2
6	BNC CONN	UG657/U	AMPH	2100-01-0003	6
7	CONN,9PIN	03-06-1091	MOLEX	2100-02-0010	1
8	PLUG,9PIN	03-06-2091	MOLEX	2100-02-0011	1
9	LOCK,SOCKET	CA-24-200-DL	CA	2100-03-0046	2
10	SOLDER LUG	1497	SMITH	2100-04-0012	6
11	PIN,FEMALE	02-06-1103	MOLEX	2100-05-0002	5
12	PIN,MALE	02-06-2103	MOLEX	2100-05-0003	5
30	CONN	60598-8	AMP	2100-05-0017	6
13	MOUNT,ADHESIVE	AHMS-A-C	PANDT	2800-00-0001	3

WAVETEK PARTS LIST	TITLE CHASSIS	ASSEMBLY NO. 1101-00-0623 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
14	TY-WRAP	TYB-23M	TB	2800-00-0006	18
15	STANDOFF	6911-2-3C	LYNTR	2800-03-0003	4
16	GROMMET,RUBBER	91117	SMITH	2800-10-0004	3
18	MOUSETAIL	2829-75-2	PUMTK	2800-12-0005	7

WAVETEK PARTS LIST	TITLE CHASSIS	ASSEMBLY NO. 1101-00-0623 PAGE: 2	REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST CHASSIS
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 172A / DWG NO. 1101-00-0623 / REV B
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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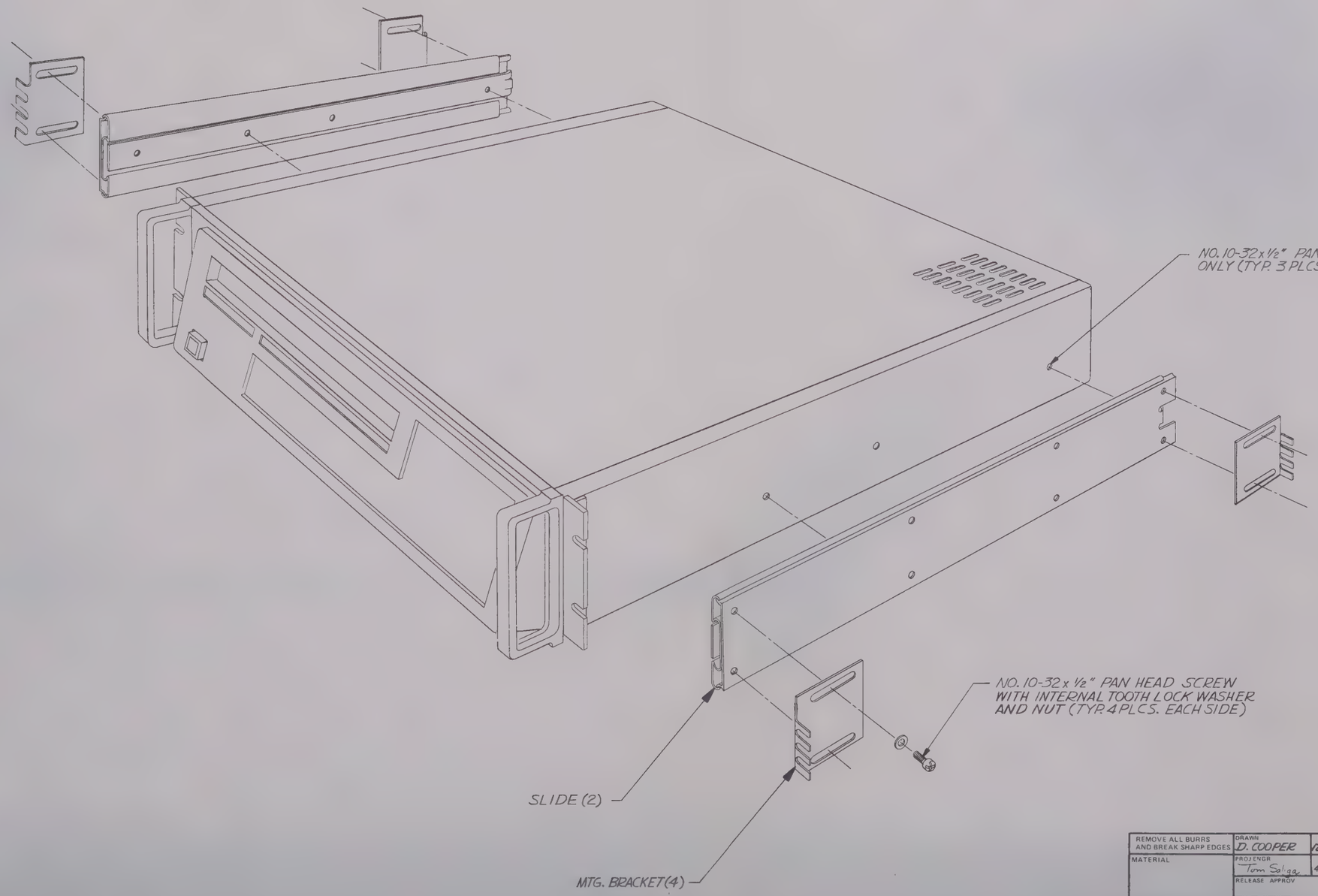
REV	ECN	BY	DATE	APP


NO. 10-32 x 1/2" PAN HEAD SCREW ONLY (TYP. 3 PLCS. EACH SIDE)
NO. 10-32 x 1/2" PAN HEAD SCREW WITH INTERNAL TOOTH LOCK WASHER AND NUT (TYP. 4 PLCS. EACH SIDE)
SLIDE (2)
MTG. BRACKET (4)

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN J. COOPER	DATE 12/3/76	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR Tom Salga	4-13-77	TITLE: ASSEMBLY DRAWING 172-007 RACK SLIDES, OPTION
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO. 0102-00-0639 / REV A
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	SLIDES	1100D-20-1	NL	2400-07-0002	2
NONE	BRACKET	JPN-SP0440	NL	2400-07-0003	4

WAVETEK PARTS LIST	TITLE CHASSIS,SLIDES	ASSEMBLY NO. 1101-00-0639 PAGE: 1	REV

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST RACK SLIDE OPTION 007
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 1101-00-0639 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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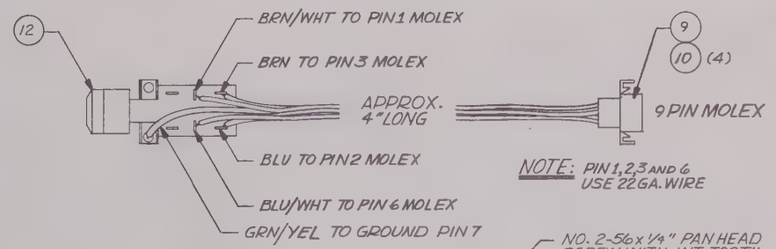
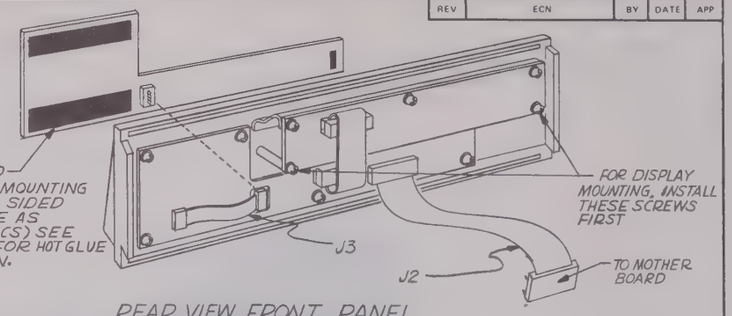
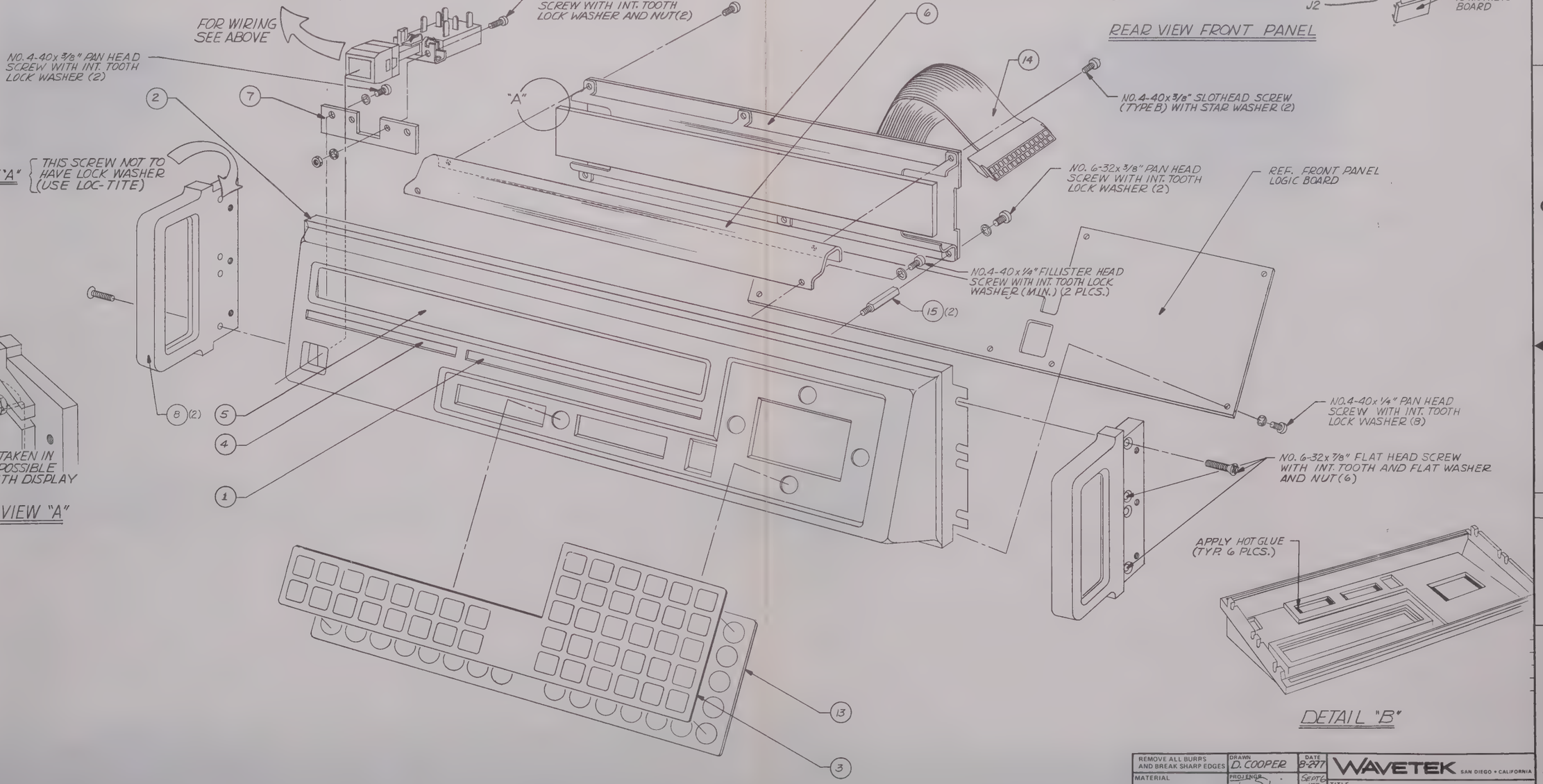
REV	ECN	BY	DATE	APP

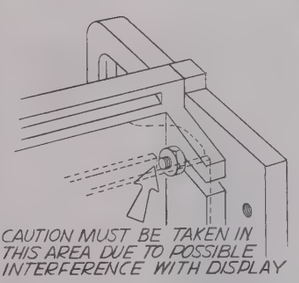


NOTE: USE MALE PINS P/N 2100-05-0003 AND PLUG P/N 2100-02-0011


FOR KEYBOARD PRELIMINARY MOUNTING USE DOUBLE SIDED SCOTCH TAPE AS SHOWN (3 PLCS) SEE DETAIL "B" FOR HOT GLUE APPLICATION.
J3
J2
FOR DISPLAY MOUNTING, INSTALL THESE SCREWS FIRST
TO MOTHER BOARD

REAR VIEW FRONT PANEL


FOR WIRING SEE ABOVE
NO. 2-56 x 1/4" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER AND NUT (2)
NO. 4-40 x 3/8" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER (2)
2
7
"A"
11
6
14
NO. 4-40 x 3/8" SLOTHEAD SCREW (TYPE B) WITH STAR WASHER (2)
SEE DETAIL VIEW "A"
THIS SCREW NOT TO HAVE LOCK WASHER (USE LOC-TITE)
NO. 6-32 x 3/8" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER (2)
REF. FRONT PANEL LOGIC BOARD
NO. 4-40 x 1/4" FILLISTER HEAD SCREW WITH INT. TOOTH LOCK WASHER (MIN.) (2 PLCS.)
15 (2)
8 (2)
5
4
1
NO. 4-40 x 1/4" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER (8)
NO. 6-32 x 7/8" FLAT HEAD SCREW WITH INT. TOOTH AND FLAT WASHER AND NUT (6)
13
3



DETAIL VIEW "A"

DETAIL "B"

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 8-2?7	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR Tom Salga	SEPT6 '77	TITLE ASSEMBLY FRONT PANEL
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0102-00-0616 REV A
	SCALE	CODE IDENT 23338	SHEET 1 OF 1

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	UNIQ-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRAG FRONT PAN.	0102-00-0616	WVTK	0102-00-0616	1
2	FRONT PANEL	1400-00-7030	WVTK	1400-00-7030	1
3	OVERLAY,KEYBOARD	1400-00-7660	WVTK	1400-00-7660	1
4	L.C.D.,INSTRUMENT	1400-00-7670	WVTK	1400-00-7670	1
5	LENS,READOUT REF:3200-03-0007	1400-00-7680	WVTK	1400-00-7680	1
6	BRKT,DISPLAY MTG	14000-00-7695	WVTK	1400-00-7693	1
7	BRKT,SWITCH MTG.	1400-00-7703	WVTK	1400-00-7703	1
1	PLATE,NAME	1400-00-8240	WVTK	1400-00-8240	1
8	HANDLE,WHITE FROM:1400-00-7921	1400-00-8309	WVTK	1400-00-8309	1
9	PLUG,VPIN	03-06-2091	MOLEX	2100-02-0011	1
10	PIN,MALE	02-06-2103	MOLEX	2100-05-0003	4
11	DISPLAY,MOD FROM:2400-03-0004	2400-03-0005	WVTK	2400-03-0005	1
15	STANDOFF	1330-M03-P05-032	UNICH	2800-02-0024	2
12	SWITCH,POWER	5102-00-0006	WVTK	5102-00-0006	1
13	KEYBOARD	1EKW7-1-7605	MICSW	5106-00-0003	1
14	CABLE ASSY	CAD261LSS-E-CO-005	CA	6002-00-0005	1

WAVETEK PARTS LIST	TITLE ASSY,FRONT PANEL	ASSEMBLY NO. 1101-00-0616 PAGE: 1	REV -

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST FRONT PANEL OPTION 001
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG	MODEL NO 172A	DWG NO 1101-00-0616 REV C
	SCALE	CODE IDENT 23338	SHEET OF

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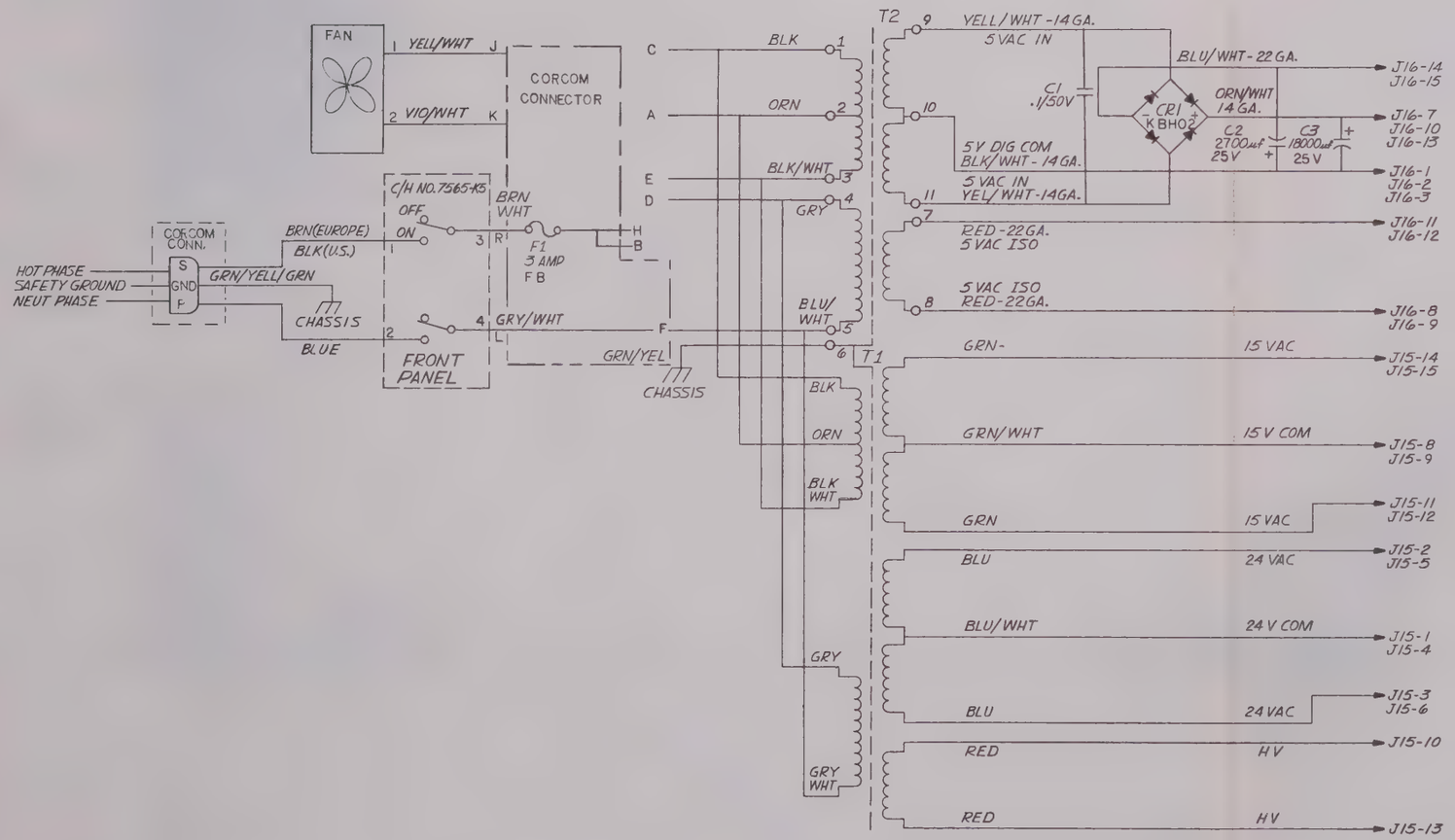
REV	ECN	BY	DATE	APP



NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-7-76
MATERIAL	PROJ ENGR	
	RELEASE APPROV	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030	
	DO NOT SCALE DWG	
	SCALE	

WAVETEK SAN DIEGO • CALIFORNIA

TITLE
SCHEMATIC
POWER SUPPLY
AND
REGULATOR REAR PANEL

MODEL NO.	DWG NO.	REV
172A	0104-00-0614	A
CODE IDENT. 23338	SHEET 1 OF 1	

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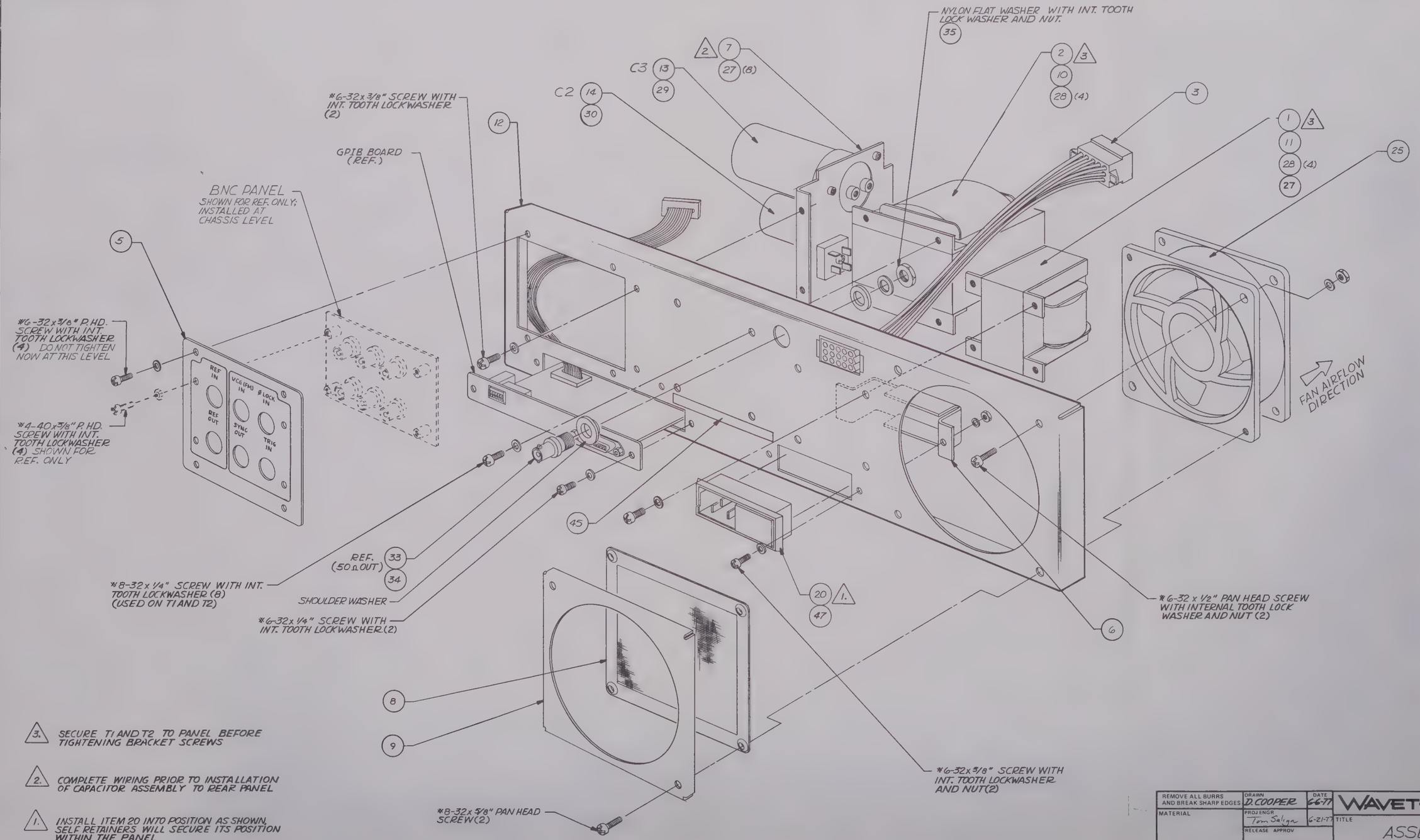
REV	ECN	BY	DATE	APP
A	GPIB INTERF STD	TJS	8SEPT	TJS



3. SECURE T1 AND T2 TO PANEL BEFORE TIGHTENING BRACKET SCREWS

2. COMPLETE WIRING PRIOR TO INSTALLATION OF CAPACITOR ASSEMBLY TO REAR PANEL

1. INSTALL ITEM 20 INTO POSITION AS SHOWN, SELF RETAINERS WILL SECURE ITS POSITION WITHIN THE PANEL

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-6-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga	6-21-77	TITLE ASSEMBLY REAR PANEL
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ±1 XX ± .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0102-00-0614 / REV A
	SCALE		CODE IDENT 23338 / SHEET 1 OF 2

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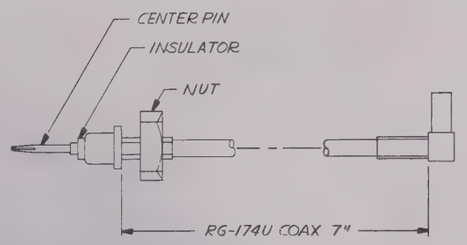
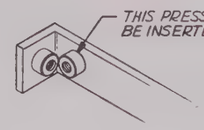
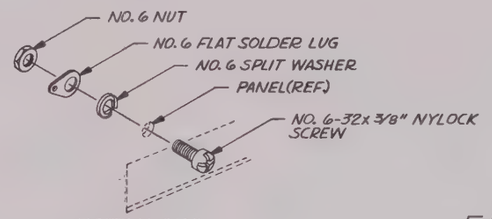
REV	ECN	BY	DATE	APP



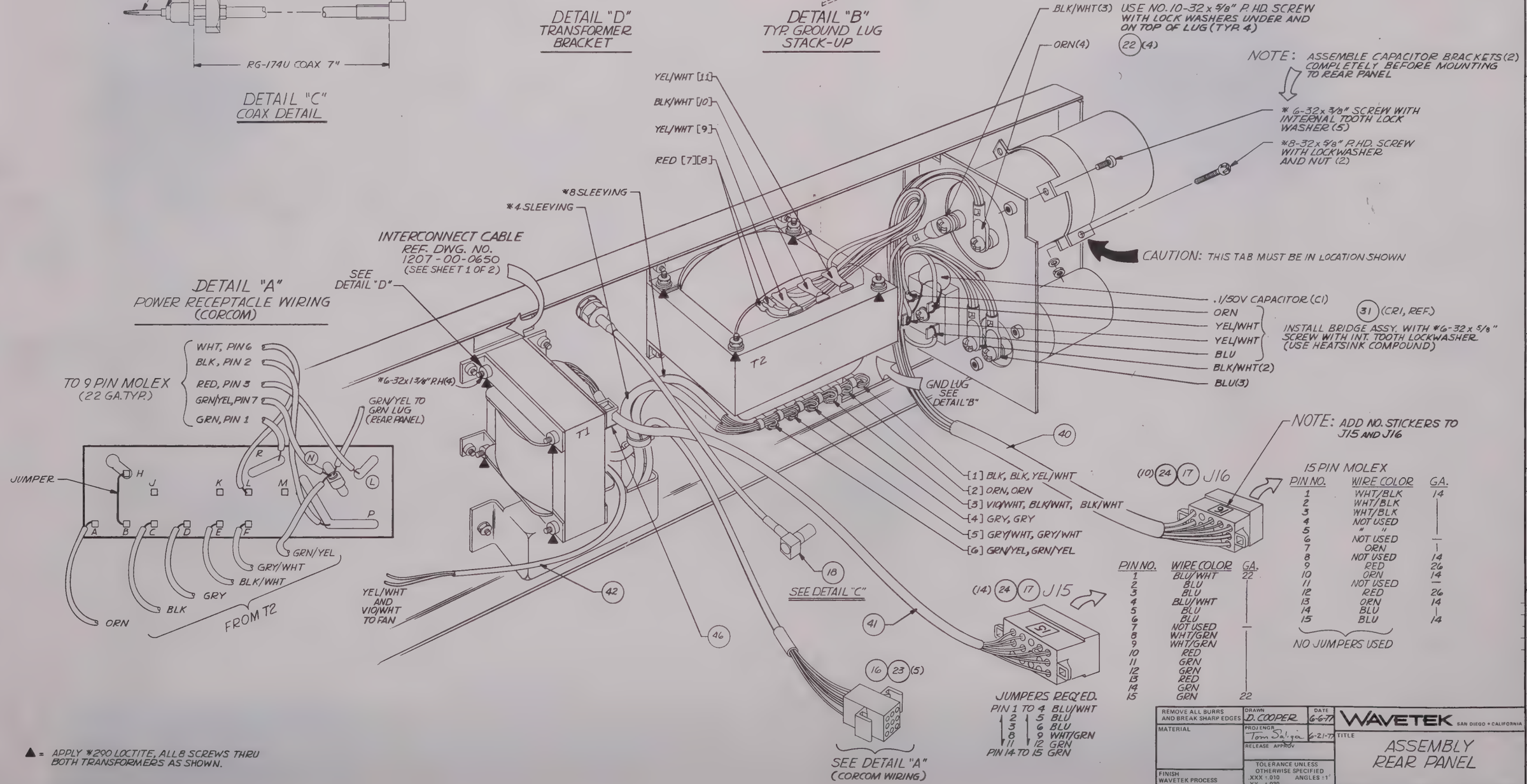
DETAIL "C"
COAX DETAIL



DETAIL "D"
TRANSFORMER BRACKET



DETAIL "B"
TYP. GROUND LUG STACK-UP



DETAIL "A"
POWER RECEPTACLE WIRING (CORCOM)

15 PIN MOLEX

PIN NO.	WIRE COLOR	GA.
1	WHT/BLK	14
2	WHT/BLK	—
3	WHT/BLK	—
4	NOT USED	—
5	" "	—
6	NOT USED	—
7	ORN	14
8	NOT USED	—
9	RED	26
10	ORN	14
11	NOT USED	—
12	RED	26
13	ORN	14
14	BLU	—
15	BLU	14

NO JUMPERS USED

PIN NO.	WIRE COLOR	GA.
1	BLU/WHT	22
2	BLU	—
3	BLU	—
4	BLU/WHT	—
5	BLU	—
6	BLU	—
7	NOT USED	—
8	WHT/GRN	—
9	WHT/GRN	—
10	RED	—
11	GRN	—
12	GRN	—
13	RED	—
14	GRN	—
15	GRN	22

JUMPERS REQ'ED.
PIN 1 TO 4 BLU/WHT
2 TO 5 BLU
3 TO 6 BLU
8 TO 9 WHT/GRN
11 TO 12 GRN
PIN 14 TO 15 GRN

▲ = APPLY *200 LOCTITE, ALL 8 SCREWS THRU BOTH TRANSFORMERS AS SHOWN.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-6-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Salga	6-21-77	TITLE ASSEMBLY REAR PANEL
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A
	SCALE		DWG NO 0102-00-0614 REV A
	CODE IDENT 23338		SHEET 2 OF 2

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,REAR PANEL	0102-00-0614	WVTK	0102-00-0614	1
NONE	SCHEMATIC,REAR PANEL	0104-00-0614	WVTK	0104-00-0614	1
1	TRANSFORMER	172-474	WVTK	1204-00-0474	1
2	TRANSFORMER	172-613	WVTK	1204-00-0613	1
3	CABLE,INTERCONNECT	172-0650	WVTK	1207-00-0650	1
6	SHIELD,PWR	1400-00-6210	WVTK	1400-00-6210	1
45	LABEL,I.D.	1400-00-6930	WVTK	1400-00-6930	1
7	BRKT	1400-00-7043	WVTK	1400-00-7043	1
9	FAN COVER	1400-00-7522	WVTK	1400-00-7522	1
11	BRKT,XFMR	1400-00-7543	WVTK	1400-00-7543	4
10	BRKT,XFMR,MTG	1400-00-7783	WVTK	1400-00-7783	2
5	BNC MTG PLATE	1400-00-7790	WVTK	1400-00-7790	1
12	REAR PANEL	1400-00-7810	WVTK	1400-00-7810	1
C1	CAP,CER,.1MF,50V	CK-104 LONG LEAD	CRL	1500-01-0400	1
14	CAP,ELECT,2700MF,25V	91C25HA272	MEPCO	1500-32-7202	1
15	CAP,ELEC,52000MF,15V	FAMH52000-15-R3	CDF	1500-35-2301	1
33	BNC CONN	KC-19-152	KING	2100-01-0006	1
16	CONN,9PIN	03-06-1091	MOLEX	2100-02-0010	1

WAVETEK PARTS LIST	TITLE REAR PANEL ASSY	ASSEMBLY NO. 1101-00-0614 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
17	PLUG,15PIN	03-09-2151	MOLEX	2100-02-0013	2
20	RECEPTACLE	6J1	CONCM	2100-03-0026	1
NONE	TERM,LUCK LUG	1414-6	SMITH	2100-04-0009	1
22	LUG # 6	35	TLSCO	2100-04-0018	4
23	PIN,FEMALE	02-06-1103	MOLEX	2100-05-0002	5
24	PIN,MALE	02-09-2118	MOLEX	2100-05-0005	24
NONE	CONN	60598-8	AMP	2100-05-0017	12
18	CONN	27-843	AMPH	2100-07-0009	1
47	LABEL,RECEPT	85-1505	CORCM	2400-04-0001	1
NONE	FUSE,250V,3A 3AG	312003	LITFU	2400-05-0018	1
8	FILTER	5502	PAMGT	2400-01-0005	1
25	FAN,MODIFIED FROM:2600-00-0005	2600-49-0002	WVTK	2600-99-0002	1
46	TIE MOUNT	TM-256C	PANDT	2800-00-0005	1
NONE	TY-WRAP	TYM-23M	TB	2800-00-0006	20
27	INSERT # 6	74-11-106-13	SOTCO	2800-09-0017	12
28	INSERT #8	74-11-108-13	SOTCO	2800-09-0018	8
29	CAP,MTG,BKT	FJMH	STM	2800-12-0006	1

WAVETEK PARTS LIST	TITLE REAR PANEL ASSY	ASSEMBLY NO. 1101-00-0614 PAGE: 2	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
30	CAP,MTG,BKT	FHMR-2	STM	2800-12-0007	1
34	WASHER,SHOULDER	2668	SMITH	2800-27-0004	1
35	NYLON FLAT WASHER	2264-N-385	AMTOM	2800-28-0005	1
40	SLEEVING,BLACK 3/8"	SLEEVING,BLACK 3/8"	NATBR	3000-00-0024	2
41	SLEEVING,BLACK #4	SLEEVING,BLACK #4	NATBR	3000-00-0025	2
42	SLEEVING,BLACK #8	SLEEVING,BLACK #8	NATBR	3000-00-0026	2
31	BRIDGE ASSY 30 AMP	MDA990-1	MOT	4899-00-0010	1

WAVETEK PARTS LIST	TITLE REAR PANEL ASSY	ASSEMBLY NO. 1101-00-0614 PAGE: 3	REV C

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST REAR PANEL
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 1101-00-0614 REV C
	SCALE	CODE IDENT 23338	SHEET OF

DESCRIPTION	MFGR	ORIG-MFGR-PART-NO	WAVETEK NO.	QTY/PT	REFDES	STATION	PREP
CONN,15PIN	MOLEX	03-09-1151	2100-02-0012	1	NONE	NA	NA
PLUG,15PIN	MOLEX	03-09-2151	2100-02-0013	1	NONE	NA	NA
PIN,MALE	MOLEX	02-09-2118	2100-05-0005	12	NONE	NA	NA
PIN,FEMALE	MOLEX	02-09-1118	2100-05-0026	12	NONE	NA	NA
WIRE,MU,22GA	GAVTT	1SU-BROWN	6000-32-2001	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-RED	6000-32-2002	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-ORANGE	6000-32-2003	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-YELLOW	6000-32-2004	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-GREEN	6000-32-2005	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-BLUE	6000-32-2006	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-VIOLET	6000-32-2007	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-GRAY	6000-32-2008	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-WHITE	6000-32-2009	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-WHITE/BLACK	6000-32-2090	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-WHITE/BROWN	6000-32-2091	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-WHITE/RED	6000-32-2092	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-WHITE/ORANGE	6000-32-2093	1	NONE	NA	DNP
WIRE,MU,22GA	GAVTT	1SU-WHITE/YELLOW	6000-32-2094	1	NONE	NA	DNP

ASSEMBLY PARTS LIST-PULL SHEET TITLE: CABLE,INTERCONNECT NO: 1207-00-0650 REV: A PAGE: 1

DESCRIPTION	MFGR	ORIG-MFGR-PART-NO	WAVETEK NO.	QTY/PT	REFDES	STATION	PREP
WIRE,MU,22GA	GAVTT	1SU-WHITE/GREEN	6000-32-2095	1	NONE	NA	DNP

ASSEMBLY PARTS LIST-PULL SHEET TITLE: CABLE,INTERCONNECT NO: 1207-00-0650 REV: A PAGE: 2

NOTE UNLESS OTHERWISE SPECIFIED

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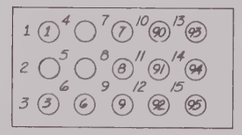
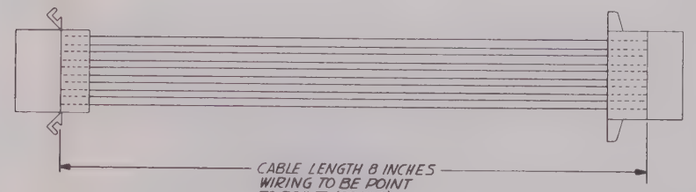
REV	ECN	BY	DATE	APP
A	UNUSED WIRES DEL.	TUS	8 SEPT	TUS





1. PINS 2,4, AND 5 NOT USED

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 4-27-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Selga	SEPT 8'77	TITLE: ASCII DATA INTERCONNECT CABLE WAVETEK BUS AUTO PROGRAMMER
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		MODEL NO. 172 / DWG NO. 1207-00-0650 / REV A
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET 1 OF 1
	SCALE		

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: CABLE INTERCONNECT
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		MODEL NO. 172A / DWG NO. 1207-00-0650 / REV A
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET 1 OF 1
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	CONN,15PIN	03-09-1151	MOLEX	2100-02-0012	1
NONE	PLUG,15PIN	03-09-2151	MOLEX	2100-02-0013	1
NONE	PIN,MALE	02-09-2118	MOLEX	2100-05-0005	12
NONE	PIN,FEMALE	02-09-1118	MOLEX	2100-05-0026	12
NONE	WIRE,MU,22GA	150-BROWN	GAVTT	6000-32-2001	1
NONE	WIRE,MU,22GA	150-RED	GAVTT	6000-32-2002	1
NONE	WIRE,MU,22GA	150-ORANGE	GAVTT	6000-32-2003	1
NONE	WIRE,MU,22GA	150-YELLOW	GAVTT	6000-32-2004	1
NONE	WIRE,MU,22GA	150-GREEN	GAVTT	6000-32-2005	1
NONE	WIRE,MU,22GA	150-BLUE	GAVTT	6000-32-2006	1
NONE	WIRE,MU,22GA	150-VIOLET	GAVTT	6000-32-2007	1
NONE	WIRE,MU,22GA	150-GRAY	GAVTT	6000-32-2008	1
NONE	WIRE,MU,22GA	150-WHITE	GAVTT	6000-32-2009	1
NONE	WIRE,MU,22GA	150-WHITE/BLACK	GAVTT	6000-32-2090	1
NONE	WIRE,MU,22GA	150-WHITE/BROWN	GAVTT	6000-32-2091	1
NONE	WIRE,MU,22GA	150-WHITE/RED	GAVTT	6000-32-2092	1
NONE	WIRE,MU,22GA	150-WHITE/ORANGE	GAVTT	6000-32-2093	1
NONE	WIRE,MU,22GA	150-WHITE/YELLOW	GAVTT	6000-32-2094	1

WAVETEK PARTS LIST	TITLE CABLE,INTERCONNECT	ASSEMBLY NO. 1207-00-0650 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	WIRE,MU,22GA	150-WHITE/GREEN	GAVTT	6000-32-2095	1

WAVETEK PARTS LIST	TITLE CABLE,INTERCONNECT	ASSEMBLY NO. 1207-00-0650 PAGE: 2	REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST CABLE INTERCONNECT
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO 172A / DWG NO 1207-00-0650 / REV A
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET 2 OF 2
	SCALE		

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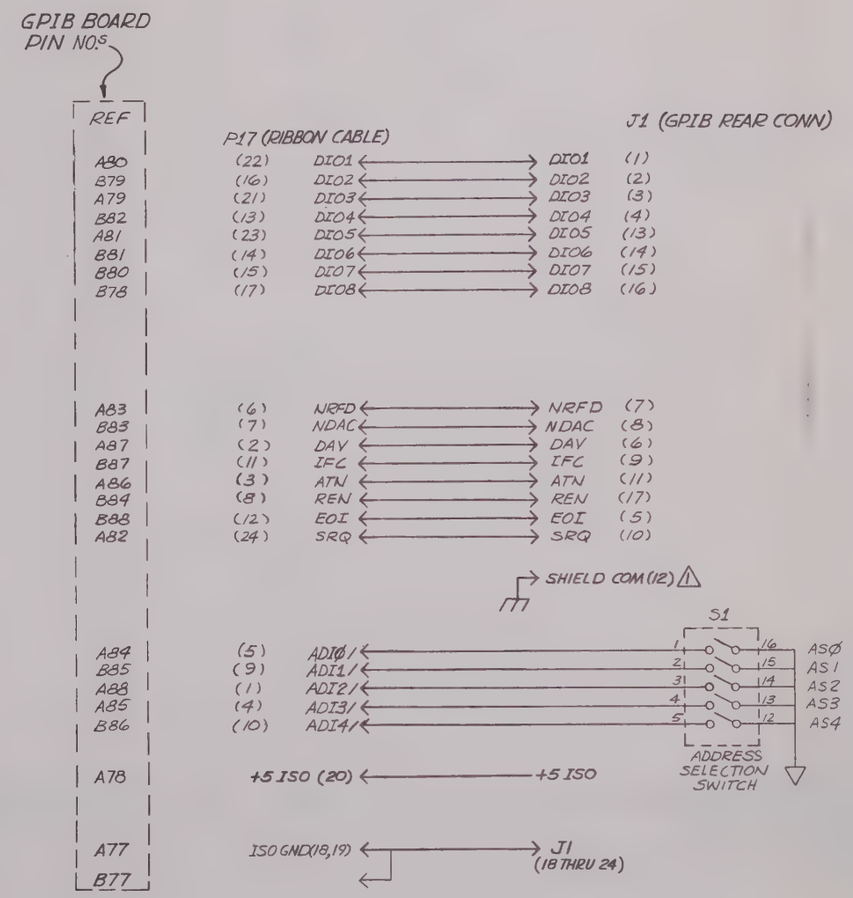
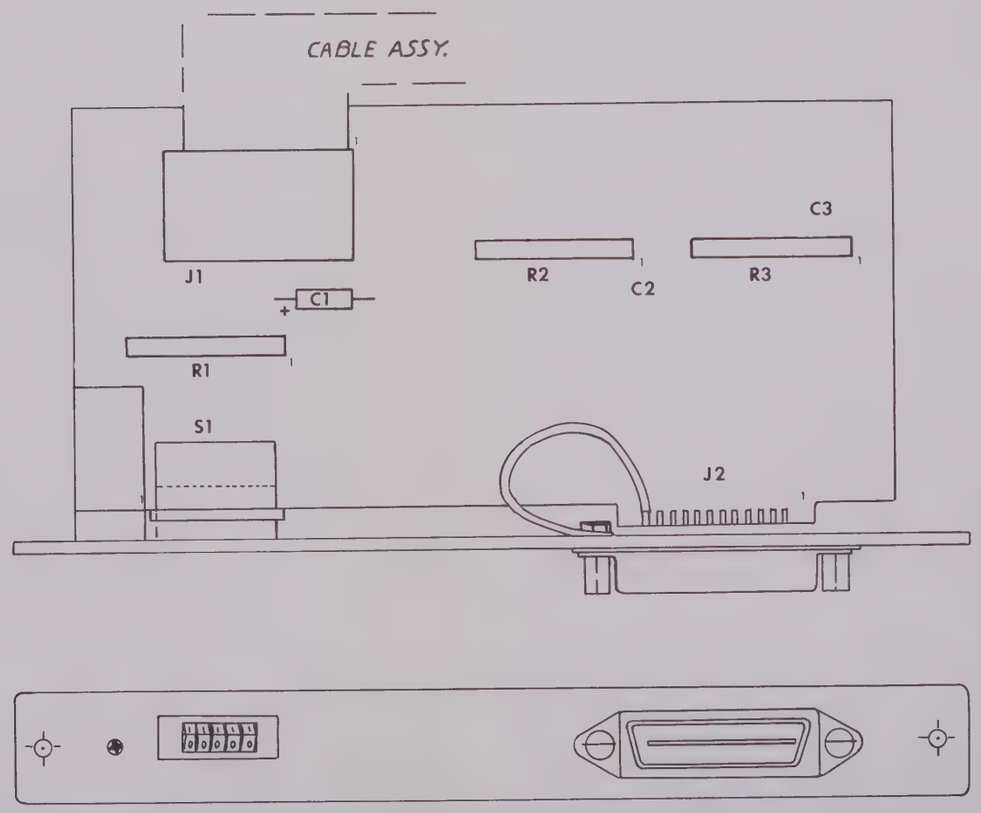
REV	ECN	BY	DATE	APP
A	"P17" WAS "J1", J1 WAS J2, "NDAC" WAS "NOAC", "ADIØ" THRU "ADI4" WAS "AOIØ" THRU "AOI4"	TLF	6-30-77	


GPIB BOARD PIN NOS
REF
J2
P17 (RIBBON CABLE)
J1 (GPIB REAR CONN)
A80 (22) DIO1 ↔ DIO1 (1)
B79 (16) DIO2 ↔ DIO2 (2)
A79 (21) DIO3 ↔ DIO3 (3)
B82 (13) DIO4 ↔ DIO4 (4)
A81 (23) DIO5 ↔ DIO5 (13)
B81 (14) DIO6 ↔ DIO6 (14)
B80 (15) DIO7 ↔ DIO7 (15)
B78 (17) DIO8 ↔ DIO8 (16)
A83 (6) NRFD ↔ NRFD (7)
B83 (7) NDAC ↔ NDAC (8)
A87 (2) DAV ↔ DAV (6)
B87 (11) IFC ↔ IFC (9)
A86 (3) ATN ↔ ATN (11)
B84 (8) REN ↔ REN (17)
B88 (12) EOI ↔ EOI (5)
A82 (24) SRQ ↔ SRQ (10)
SHIELD COM (12) ⚠
S1
A84 (5) ADIØ/ ↔ ASØ
B85 (9) ADI1/ ↔ AS1
A88 (1) ADI2/ ↔ AS2
A85 (4) ADI3/ ↔ AS3
B86 (10) ADI4/ ↔ AS4
ADDRESS SELECTION SWITCH
A78 +5 ISO (20) ↔ +5 ISO
A77 ISO GND (18,19) ↔ J1 (18 THRU 24)
B77

⚠ GREEN WIRE TO CHASSIS GROUND

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN T. FOSTER	DATE 5/6/77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL —	PROJ ENGR Tom Dalga	SEPT 6/77	TITLE SCHEMATIC - BACK PANEL, GPIB REAR INTERFACE
FINISH WAVETEK PROCESS —	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0103-00-0554 REV A
	SCALE —	CODE IDENT 23338	SHEET 1 OF 1



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: ASSEMBLY GPIB DECODER ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0554 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG DECODER	0101-00-0554	WVTK	0101-00-0554	1
NONE	SCHEMATIC DECODER	0103-00-0554	WVTK	0103-00-0554	1
NONE	CONN. BLOCK	157-314	WVTK	1400-00-3043	1
NONE	CONN PLATE	1400-00-6610	WVTK	1400-00-6610	1
C2 C3	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	2
NONE	DECODER	1700-00-0554	WVTK	1700-00-0554	1
J1	CONN	57-20240	AMPH	2100-02-0060	1
NONE	SOCKET	516-AG7D	AUGAT	2100-03-0034	1
NONE	TERM,LOCK LUG	1414-6	SMITH	2100-04-0009	1
NONE	JACK SCREW	408-146475	AMPH	2800-23-0008	2
S1	SWITCH PC	500-105	DUNCN	5199-00-0001	1
P17	INTERCONNECT CABLE	CA-D24P02-26-1TT-016	CA	6002-00-0002	1

WAVETEK PARTS LIST	TITLE PCA,GPIB REAR INTERF	ASSEMBLY NO. 1100-00-0554	REV E
		PAGE: 1	

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST GPIB DECODER
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± 010 ANGLES ±1° XX ± 030		
	DO NOT SCALE DWG	MODEL NO 172A	DWG NO 1100-00-0554 REV E
	SCALE	CODE IDENT 23338	SHEET OF

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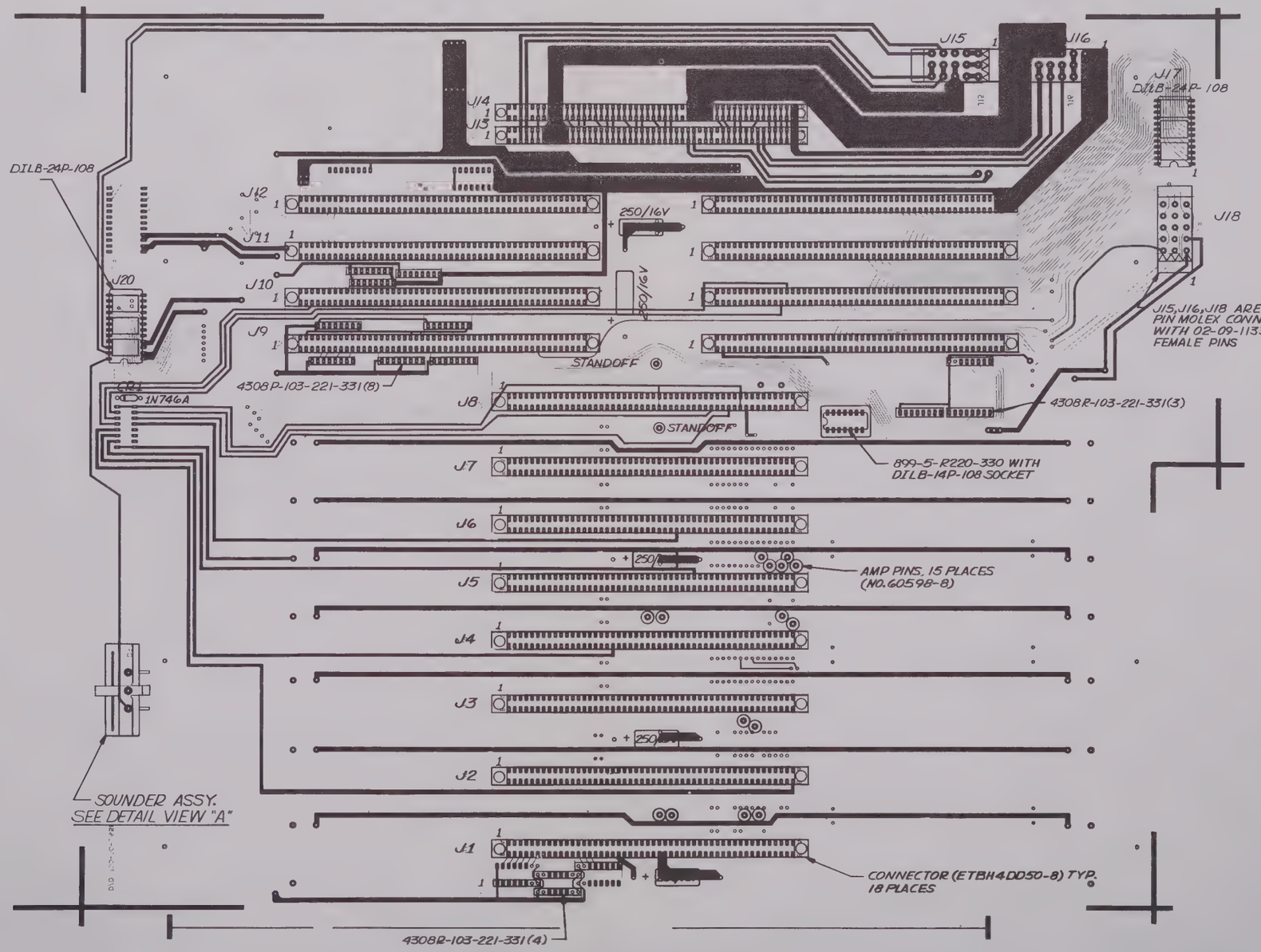
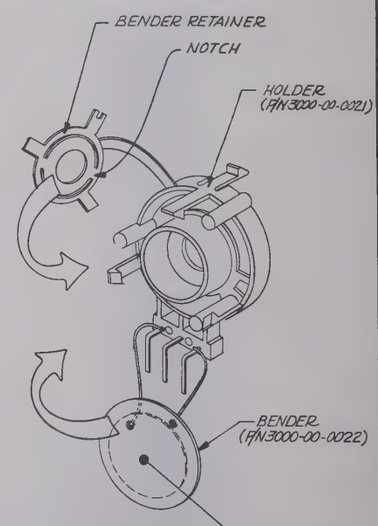
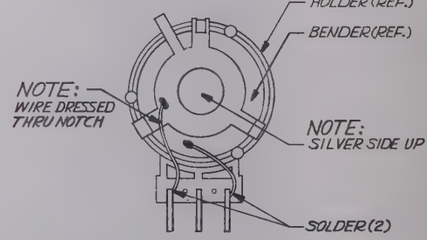
REV	ECN	BY	DATE	APP



DETAIL VIEW "A"
SOUNDER ASSEMBLY





ASSEMBLED VIEW

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 9-4-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga	SEPT 6'77	TITLE ASSEMBLY MOTHER BOARD
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		
	SCALE		MODEL NO. 172A · DWG NO. 0101-00-0651 · REV A
			CODE IDENT 23338 · SHEET 1 OF 1

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG MOTHER	0101-00-0651	WVTK	0101-00-0651	1
C1 C2 C3 C4 C5	CAP,ELECT,250MF,16V	S00D257G016DF7	SPRAG	1500-32-5101	5
NONE	MOTHER BOARD	1700-00-0651	WVTK	1700-00-0651	1
J15 J16 J18	CONN,15PIN	03-09-1151	MOLEX	2100-02-0012	3
NONE	CONN	ETBM4DDS0-8	BURND	2100-03-0031	18
NONE	SOCKET,14 PIN	DILB-14P-108	BURND	2100-03-0032	1
J17 J20	SKT,IC,24 PIN	CA-24SPU-10SD	CA	2100-03-0045	2
NONE	PIN,FEMALE	02-09-1133	MOLEX	2100-05-0004	45
NONE	CONN	66598-8	AMP	2100-05-0017	17
NONE	STANDOFF	6911-2-3C	LYNTH	2600-03-0003	2
NONE	MOLDER,BENDER	15-24-2034	MOLEX	3000-00-0021	1
NONE	BENDER W/2" 30GA WIRE LEADS	101	GULTN	3000-00-0022	1
NONE	RES MODULE	899-5-R220/330	BECK	4770-00-0004	1
NONE	RES MODULE	4308R-103-221/331	BOURN	4770-00-0013	15
CR1	DIODE	1N746A	SIEM	4801-01-0746	1

WAVETEK PARTS LIST	TITLE PCA,MOTHER	ASSEMBLY NO. 1100-00-0651 PAGE: 1	REV

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST MOTHER BOARD
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 1100-00-0651 REV
	SCALE	CODE IDENT 23338	SHEET OF

Signal Routing on Mother Board

1. Terminators are on each line of the bus formed by pins 1 thru 15 of connectors J1 thru J8 and pins 33 thru 47 of connectors J9 thru J12. Typical terminator:

2. Terminators are on each line of the bus of pins 5 thru 29 of connectors J9 thru J12.

3. Terminators are on each line of the bus of pins 90 thru 99 of connectors J9 thru J12.

4. Capacitors on the mother board are tied to +5V on the positive side and grounded on the other side.

J20, Front Panel

1	+5V
2	
3	Common
4	
5	DBUS 7/
6	DBUS 5/
7	KB OUT/
8	DBUS 3/
9	DBUS 4/
10	DBUS 1/
11	DBUS 2/
12	DBUS 0/
13	WRP
14	DISPEN/
15	ABUS 0/
16	ABUS 2/
17	ABUS 1/
18	ABUS 4/
19	ABUS 3/
20	AUDIO
21	ABUS 5/
22	250 Volts ac
23	
24	−12 Volts

J1/Digits 4 and 5/Reference (-0501)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
(SYNPR - 0)		
C11	15	CI0
(LOCK 0)		(CAUTION 0)
SYN 45 - 1	16	SYN45 - 1
COM 45	17	COM 45
MC COM	18	MC0.5
+5V	19, 20	+5V
	21	
MC0.1	21	MC0.1
±5V	22, 23, 24	±5V
GND		GND
CLR0	25	CLR0
±15V	26, 27, 28	±15V
GND		GND
	29	
−15V	30, 31	−15V
REF IN	29	REF IN
−15V	30, 31	−15V
	32	
+15V	33, 34	+15V
	35	
	36	
	37	
MC30	38	MC30
MC30	39	MC30
	40	
	41	
	42	
	43	
INT 10	44	
REF OUT	45	
	44	
	45	
MC60 - 0	46	MC60 - 0
MC60	47	MC60
	48	
	49	
−5V	50	−5V

J2/Digits 2 and 3 (-0500)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
SYN 45 - 1	16	SYN45 - 1
COM 45	17	COM 45
MC COM	18	MC0.5
+5V	19, 20	+5V
	21	
MC0.1	21	MC0.1
±5V	22, 23, 24	±5V
GND		GND
CLR0	25	CLR0
±15V	26, 27, 28	±15V
GND		GND
	29	
−15V	30, 31	−15V
	32	
+15V	33, 34	+15V
DIG 23 - 0	35	DIG 23 - 0
DIG 23 - 1	36	DIG 23 - 1
	37	
MC30	38	MC30
MC30	39	MC30
	40	
	41	
	42	
	43	
	44	
	45	
MC60	46	MC60
MC60	47	MC60
	48	
	49	
−5V	50	−5V

J3/Digit 1/Mixer (-0509)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
GND	16	XRD/
	17	
MC COM	18	MC0.5
+5V	19, 20	+5V
	21	
MC0.1	21	MC0.1
±5V	22, 23, 24	±5V
GND		GND
CLR0	25	CLR0
±15V	26, 27, 28	±15V
GND		GND
	29	
−15V	30, 31	−15V
	32	
+15V	33, 34	+15V
DIG 23 - 0	35	DIG 23 - 0
DIG 23 - 1	36	DIG 23 - 1
	37	
MC30	38	MC30
MC30	39	MC30
	40	
	41	
	42	
	43	
	44	
	45	
SYNOB	46	SYNOB
SYNOA	47	SYNOA
	48	
	49	
5V	50	−5V

J4/VCG and Symmetry (-0612)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
	16	
	17	
	18	
GVC	21	
±15V	25	VCG
	26	
GND	27	GND
	28	
	29	
15V	30, 31	−15V
	32	
+15V	33, 34	+15V
	35	
I+	36	I+
COM	37	COM
CI	38	CI
COM	39	COM
I-	40	I−
−24V	41	−24V
	42	
+24V	43	+24V
GEN OUT	44	GEN OUT
COM	45	COM
SYNOB	46	SYNOB
COM	47	COM
SYNOA	48	SYNOA
COM	49	COM
φ LOCK IN	50	φ LOCK-IN

J5/Triangle Generator (-0635)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
	16	
	17	
B	18	B
+5V	19, 20	+5V
	21	
·5V	22, 23, 24	±5V
GND		GND
TRI	25	TRI
·15V	26, 27, 28	±15V
GND		GND
	29	
-15V	30, 31	−15V
	32	
+15V	33, 34	+15V
	35	
I+	36	I+
COM	37	COM
CI	38	CI
COM	39	COM
I-	40	I−
COM	41	COM
	42	
COM	43	COM
GEN OUT	44	GEN OUT
COM	45	COM
SYNC OUT	46	SYNC OUT
COM	47	COM
MAN TRIG	48	MAN TRIG
COM	49	COM
TRIG IN	50	TRIG IN

J6/Function/Preamp (-0490)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
	16	
	17	
B	18	B
+5V	19, 20	+5V
	21	
·5V	22, 23, 24	±5V
GND		GND
A	25	A
±15V	26, 27, 28	±15V
GND		GND
	29	
-15V	30, 31	−15V
	32	
+15V	33, 34	+15V
	35	
−24V	36, 37	−24V
	38	
+24V	39, 40	+24V
	41	
−5V	42	-5V
	43	
↕24	44	↕24
GND	45	GND
(↕24 CT	46	(↕24 CT
XFMR)	47	XFMR)
	48	
	49	
	50	

J7/3 Digit Attenuator (-0638)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
	16	
	17	
B	18	B
+5V	19, 20	+5V
	21	
±5V	22, 23, 24	±5V
GND		GND
A	25	A
±15V	26, 27, 28	±15V
GND		GND
	29	
-15V	30, 31	−15V
	32	
+15V	33, 34	+15V
	35	
I+	36	I+
COM	37	COM
CI	38	CI
COM	39	COM
I-	40	I−
COM	41	COM
	42	
COM	43	COM
GEN OUT	44	GEN OUT
COM	45	COM
SYNC OUT	46	SYNC OUT
COM	47	COM
MAN TRIG	48	MAN TRIG
COM	49	COM
TRIG IN	50	TRIG IN

J8/Power Amplifier/DC Offset (-0590)

B Side	Pin	A Side
C07	1	Strobe
C06	2	A3
C05	3	A2
C04	4	A1
C03	5	A0
C02	6	XSGN/
C01	7	D7
C00	8	D6
C17	9	D5
C16	10	D4
C15	11	D3
C14	12	D2
C13	13	D1
C12	14	D0
C11	15	CI0
GND	16	XRD/
	17	
	18	
+5V	19, 20	+5V
	21	
±5V	22, 23, 24	±5V
GND		GND
+5V	49, 50	+5V
	51	
−5V	52	−5V
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
+5V ISO COM	62	+5V ISO COM
+5V ISO	63	+5V ISO
	64	
	65	
	66	
	67	
	68	
	69	
	70	
WBCLK/	71	BUSV/
WB7/	72	WB6/
WB5/	73	WB4/
WB3/	74	WB2/
WB1/	75	WB0/
	76	
+5V	77	+5V
GND	78	ISO
	79	
XDB1	80	XDB0
XDB3	81	XDB2
	82	
	83	
	84	
	85	
	86	IS3
IS2	87	IS1
IS0	88	IS3/
	89	
14/	90	15/
12/	91	13/
10/	92	11/
8/	93	9/
6/	94	7/
4/	95	5/
2/	96	3/
ABUS0/	97	ABUS1/
	98	
0	99	
	100	

J9/Option Interface (GPIB -0643 or 154/157 Emulator -0491)

B Side	Pin	A Side
+5V GND	1, 2	±5V GND
+12V	3	+12V
	4	
DBUS0/	5	DBUS1/
DBUS2/	6	DBUS3/
DBUS4/	7	DBUS5/
DBUS6/	8	DBUS7/
	9	
OPACK/	10	OPREQ/
M/$\overline{IO}$	11	E/NE
$\overline{RD}$/WT	12	WRP
	13	RDMA/
INTREQ/	14	INTACK
FLAG/	15	SENSE/
RESET/	16	RUN/$\overline{WAIT}$
WIOD/	17	RIOD/
	18	
	19	
	20	
	21	
KBOUT/	22	DISPEN/
KBIN/	23	KBLCH/
	24	
	25	
	26	
	27	SYS CLK 4
SYS CLK 3	28	SYS CLK 2
SYS CLK 1	29	SYS CLK 0
	30	
	31	
	32	
C07	33	STROBE
C06	34	A3
C05	35	A2
C04	36	A1
C03	37	A0
C02	38	XSGN/
C01	39	D7
C00	40	D6
C17	41	D5
C16	42	D4
C15	43	D3
C14	44	D2
C13	45	D1
C12	46	D0
C11	47	CIO
	48	
+5V	49, 50	+5V
	51	
−5V	52	−5V
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
+5V ISO COM	62	+5V ISO COM
+5V ISO	63	+5V ISO
	64	
	65	
	66	
	67	
	68	
	69	
	70	
WBCLK/	71	BUSV/
WB7/	72	WB6/
WB5/	73	WB4/
WB3/	74	WB2/
WB1/	75	WB0/
	76	
+5V	77	+5V
GND	78	ISO
	79	
XDB1	80	XDB0
XDB3	81	XDB2
	82	
	83	
	84	
	85	
	86	IS3
IS2	87	IS1
IS0	88	IS3/
	89	
14/	90	15/
12/	91	13/
10/	92	11/
8/	93	9/
6/	94	7/
4/	95	5/
2/	96	3/
ABUS0/	97	ABUS1/
	98	
0	99	
	100	

J10/Microprocessor (-0647)

B Side	Pin	A Side
+5V GND	1, 2	+5V GND
+12V	3	+12V
	4	
DBUS0/	5	DBUS1/
DBUS2/	6	DBUS3/
DBUS4/	7	DBUS5/
DBUS6/	8	DBUS7/
	9	
OPACK/	10	OPREQ/
M/$\overline{IO}$	11	E/NE
$\overline{RD}$/WT	12	WRP
	13	RDMA/
INTREQ/	14	INTACK
FLAG/	15	SENSE/
RESET/	16	RUN/$\overline{WAIT}$
WIOD/	17	RIOD/
	18	
	19	
	20	
	21	
KBOUT/	22	DISPEN/
KBIN/	23	KBLCH/
	24	
	25	
	26	
	27	SYS CLK 4
SYS CLK 3	28	SYS CLK 2
SYS CLK 1	29	SYS CLK 0
	30	
	31	
	32	
C07	33	STROBE
C06	34	A3
C05	35	A2
C04	36	A1
C03	37	A0
C02	38	XSGN/
C01	39	D7
C00	40	D6
C17	41	D5
C16	42	D4
C15	43	D3
C14	44	D2
C13	45	D1
C12	46	D0
C11	47	CIO
	48	
+5V	49, 50	+5V
	51	
−5V	52	−5V
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
+5V ISO COM	62	+5V ISO COM
+5V ISO	63	+5V ISO
	64	
	65	
	66	
	67	
	68	
	69	
	70	
WBCLK/	71	BUSV/
WB7/	72	WB6/
WB5/	73	WB4/
WB3/	74	WB2/
WB1/	75	WB0/
	76	
+5V	77	+5V
GND	78	ISO
	79	
XDB1	80	XDB0
XDB3	81	XDB2
	82	
	83	
	84	
	85	
	86	IS3
IS2	87	IS1
IS0	88	IS3/
	89	
15/	90	14/
13/	91	12/
11/	92	10/
9/	93	8/
7/	94	6/
5/	95	4/
3/	96	2/
ABUS1/	97	ABUS0/
	98	
	99	0
	100	

J11/Memory RAM (-0493)

B Side	Pin	A Side
+5V GND	1, 2	+5V GND
+12V	3	+12V
	4	
DBUS0/	5	DBUS1/
DBUS2/	6	DBUS3/
DBUS4/	7	DBUS5/
DBUS6/	8	DBUS7/
	9	
OPACK/	10	OPREQ/
M/$\overline{IO}$	11	E/NE
$\overline{RD}$/WT	12	WRP
	13	RDMA/
INTREQ/	14	INTACK
FLAG/	15	SENSE/
RESET/	16	RUN/WAIT
WIOD/	17	RIOD/
	18	
	19	
	20	
	21	
KBOUT/	22	DISPEN/
KBIN/	23	KBLCH/
	24	
	25	
	26	
	27	SYS CLK 4
SYS CLK 3	28	SYS CLK 2
SYS CLK 1	29	SYS CLK 0
	30	
	31	
	32	
C07	33	STROBE
C06	34	A3
C05	35	A2
C04	36	A1
C03	37	A0
C02	38	XSGN/
C01	39	D7
C00	40	D6
C17	41	D5
C16	42	D4
C15	43	D3
C14	44	D2
C13	45	D1
C12	46	D0
C11	47	CIO
	48	
+5V	49, 50	+5V
	51	
-5V	52	-5V
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
+5V ISO COM	62	+5V ISO COM
+5V ISO	63	+5V ISO
	64	
	65	
	66	
	67	
	68	
	69	
	70	
WBCLK/	71	BUSV/
WB7/	72	WB6/
WB5/	73	WB4/
WB3/	74	WB2/
WB1/	75	WB0/
	76	
+5V	77	+5V
ISO	78	ISO
	79	
XDB0	80	XDB0
XDB2	81	XDB2
	82	
	83	
	84	
	85	
IS3	86	IS3
IS1	87	IS1
IS3/	88	IS3/
	89	
15/	90	14/
13/	91	12/
11/	92	10/
9/	93	8/
7/	94	6/
5/	95	4/
3/	96	2/
ABUS1/	97	ABUS0/
	98	
	99	0
	100	

J12/Memory PROM (-0494)

B Side	Pin	A Side
+5V GND	1, 2	±5V GND
+12V	3	+12V
	4	
DBUS0/	5	DBUS1/
DBUS2/	6	DBUS3/
DBUS4/	7	DBUS5/
DBUS6/	8	DBUS7/
	9	
OPACK/	10	OPREQ/
M/$\overline{IO}$	11	E/NE
$\overline{RD}$/WT	12	WRP
	13	RDMA/
INTREQ/	14	INTACK
FLAG/	15	SENSE/
RESET/	16	RUN/$\overline{WAIT}$
WIOD/	17	RIOD/
	18	
	19	
	20	
	21	
KBOUT/	22	DISPEN/
KBIN/	23	KBLCH/
	24	
	25	
	26	
	27	SYS CLK 4
SYS CLK 3	28	SYS CLK 2
SYS CLK 1	29	SYS CLK 0
	30	
	31	
	32	
C07	33	STROBE
C06	34	A3
C05	35	A2
C04	36	A1
C03	37	A0
C02	38	XSGN/
C01	39	D7
C00	40	D6
C17	41	D5
C16	42	D4
C15	43	D3
C14	44	D2
C13	45	D1
C12	46	D0
C11	47	CIO
	48	
+5V	49, 50	+5V
	51	
−5V	52	−5V
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
+5V ISO COM	62	+5V ISO COM
+5V ISO	63	+5V ISO
	64	
	65	
	66	
	67	
	68	
	69	
	70	
WBCLK/	71	BUSV/
WB7/	72	WB6/
WB5/	73	WB4/
WB3/	74	WB2/
WB1/	75	WB0/
	76	
+5V	77	+5V
ISO	78	ISO
	79	
XDB0	80	XDB0
XDB2	81	XDB2
	82	
	83	
	84	
	85	
IS3	86	IS3
IS1	87	IS1
IS3/	88	IS3/
	89	
15/	90	14/
13/	91	12/
11/	92	10/
9/	93	8/
7/	94	6/
5/	95	4/
3/	96	2/
ABUS1/	97	ABUS0/
	98	
	99	0
	100	

J13/Power Supply Regulator (-0633)

B Side	Pin	A Side
OUT	1	IN
OUT	2	IN
±15V	3, 4	±15V
AC		AC
+12V	5, 6	+12V
±15,	7	±15,
±12	8	±12
COM	9	COM
	10	
	11	
B	12	B
C	13	C
E	14	E
15V	15, 16	−15V
B	17	B
C	18	C
E	19	E
+15V	20, 21	+15V
B	22	B
C	23	C
E	24	E
-24V	25, 26	−24V
B	27	B
C	28	C
E	29	E
+24V	30, 31	+24V
±24AC	32	±24AC
	33	
	34	
±24	35, 36	±24
COM	37	COM
+5D	38	+5D
+5S	39	+5S
+5V	40, 41	+5V
±5V	42, 43	±5V
COM	43	COM
ISO AC	44	ISO AC
From Xfmr	45	From Xfmr
−5V	46	−5V
ISO IN	47	ISO IN
ISO COM	48	ISO COM
ISO +5V	49	ISO +5V
−5V IN	50	−5V IN
From Diode Bridge		

J14/Pass Transistor/Regulator (-0634)

B Side	Pin	
IN	1	High Voltage
IN	2	
±15V	3	
AC	4	
	5	
+12V	6	
	7	
±15V	8	
CT	9	
	10	
B	11	
C	12	
	13	
E	14	
	15	
B	16	
C	17	
	18	
E	19	
	20	
B	21	
C	22	
	23	
E	24	
	25	
B	26	
C	27	
	28	
E	29	
	30	
+5V IN	31	To "+" of 18,000 μF
TIP 29-C	32	
	33	
	34	
	35	
	36	
TIP 29-B	37	
TIP 35-E	38	
+5V	39	
	40	
	41	
	42	
	43	
±5V	44	
COM	45	
−5V	46	
ISO IN	47	
ISO COM	48	
ISO +5V	49	
−5V IN	50	

J18, Wavetek Bus

1	COM
2	
3	KINH
4	
5	
6	BUSY
7	COM
8	XD2
9	XD4
10	XD3
11	XD1
12	XD5
13	XD0
14	XD6
15	XCLK

J17, I/O Lines

1	ADI2/
2	DAV
3	ATN
4	ADI3/
5	ADI0/
6	NRFD
7	NDAC
8	REN
9	ADI1/
10	ADI4/
11	IFC
12	EOI
13	DIO4
14	DIO6
15	DIO7
16	DIO2
17	DIO8
18	ISO GND
19	ISO GND
20	+5V ISO
21	DIO3
22	DIO1
23	DIO5
24	SRQ

J15, 15V & 24V TRANSFORMER

1	24V Common
4	
2	24 Vac
5	
3	24 Vac
6	
8	15V Common
9	
11	15 Vac
12	
14	15 Vac
15	
10	HV
13	HV

24V Winding; 15V Winding; 250V Winding

J16, 5V TRANSFORMER

1	Digital Common
2	
3	
7	+5V Unregulated
10	
13	
8	5V ISO
9	
11	5V ISO
12	
14	5V Unregulated
15	

AC Winding

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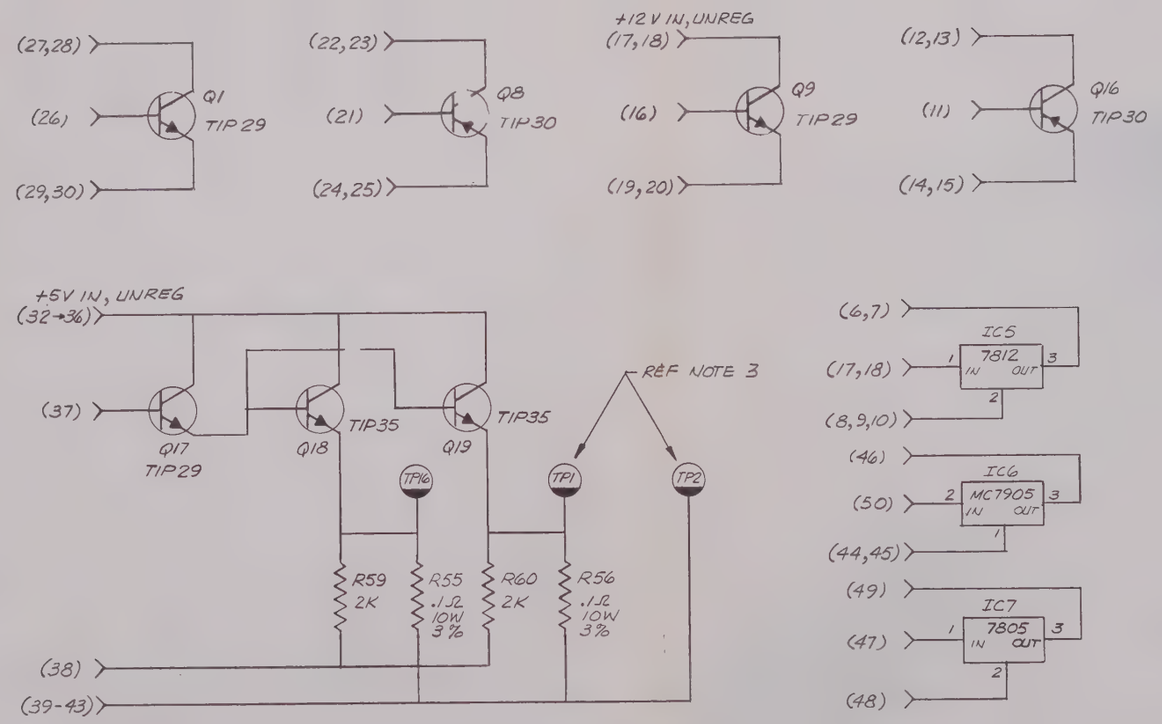
REV	ECN	BY	DATE	APP
A		TLF	8-24-77	



LAST DESIG USED: IC7 , Q19 , R60

3. I_L (+5V) ≅ (V_{TP1} - V_{TP2}) x 20 AMPS .
2. THIS SCHEMATIC IS REFERENCED ON THE POWER SUPPLY NO. 0103-00-0633 .
1. ALL I/O PIN DESIGNATIONS ARE ON J14 .

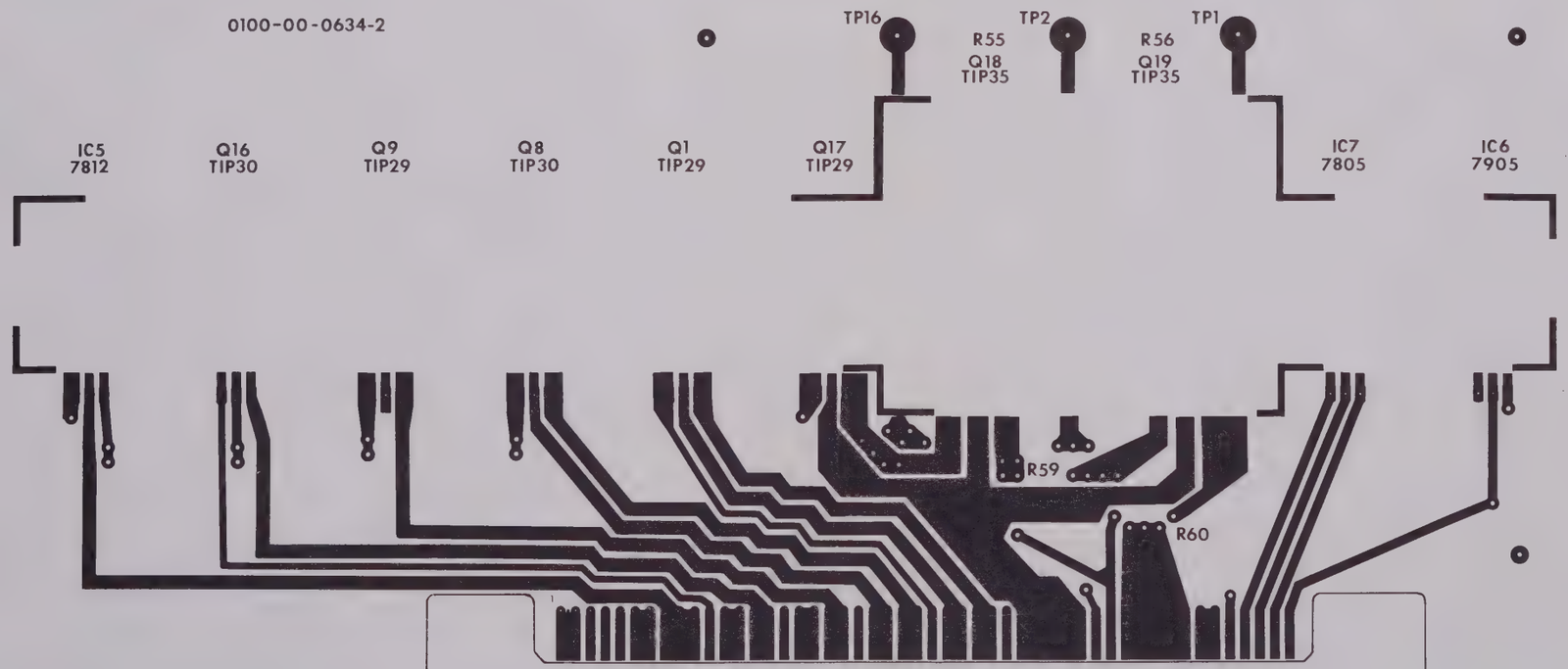
NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN T. FOSTER	DATE 7-1-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR tom Salga	7 SEPT '77	TITLE: SCHEMATIC- PASS TRANSISTOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1 .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 0103-00-0634 / REV A
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

0103-00-0634

0100-00-0634-2

D/D 1700-00-0634



PASS TRANSISTOR BOARD

ASSEMBLY _____ REV _____

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROTENGR		TITLE: ASSEMBLY PASS TRANSISTOR/ REGULATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0634 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,REGULATOR	0101-00-0634	WVTK	0101-00-0634	1
NONE	SCHEMATIC,POWER SUPP	0103-00-0633	WVTK	0103-00-0633	1
NONE	SCHEMATIC,REGULATOR	0103-00-0634	WVTK	0103-00-0634	1
NONE	HEATSINK FROM13200-06-0010	1400-00-7933	WVTK	1400-00-7933	1
NONE	REGULATOR	1700-00-0634	WVTK	1700-00-0634	1
NONE	STANDOFF	6911-2-3C	LYNTR	2600-03-0003	5
NONE	PC BD EJECTOR	103 BLACK	CALMR	2800-07-0017	2
R59 R60	RES,MF,1/8W,1%,2K	MN55G-2001F	TRW	4701-03-2001	2
R55 R56	RES,WW,10W,3%,.1 OHM	RH10-.1 OHM 3%	DALE	4702-77-0019	2
Q1 Q17 Q9	TRANS	TIP-29	TI	4902-00-0290	3
Q16 Q8	TRANS	TIP-36	TI	4902-00-0300	2
Q18 Q19	TRANS	TIP-35	TI	4902-00-0350	2
IC5	IC	MC7812CP	MOT	7000-78-1200	1
IC6	IC	MC7905CP	MOT	7000-79-0500	1
IC7	VOLTAGE REGULATOR	7805393	FAIR	8000-78-0500	1

WAVETEK PARTS LIST	TITLE PCA,REGULATOR	ASSEMBLY NO. 1100-00-0634	REV
		PAGE: 1	

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST PASS TRANSISTOR/ REGULATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG	MODEL NO 172A	DWG NO. 1100-00-0634 REV
	SCALE	CODE IDENT 23338	SHEET OF

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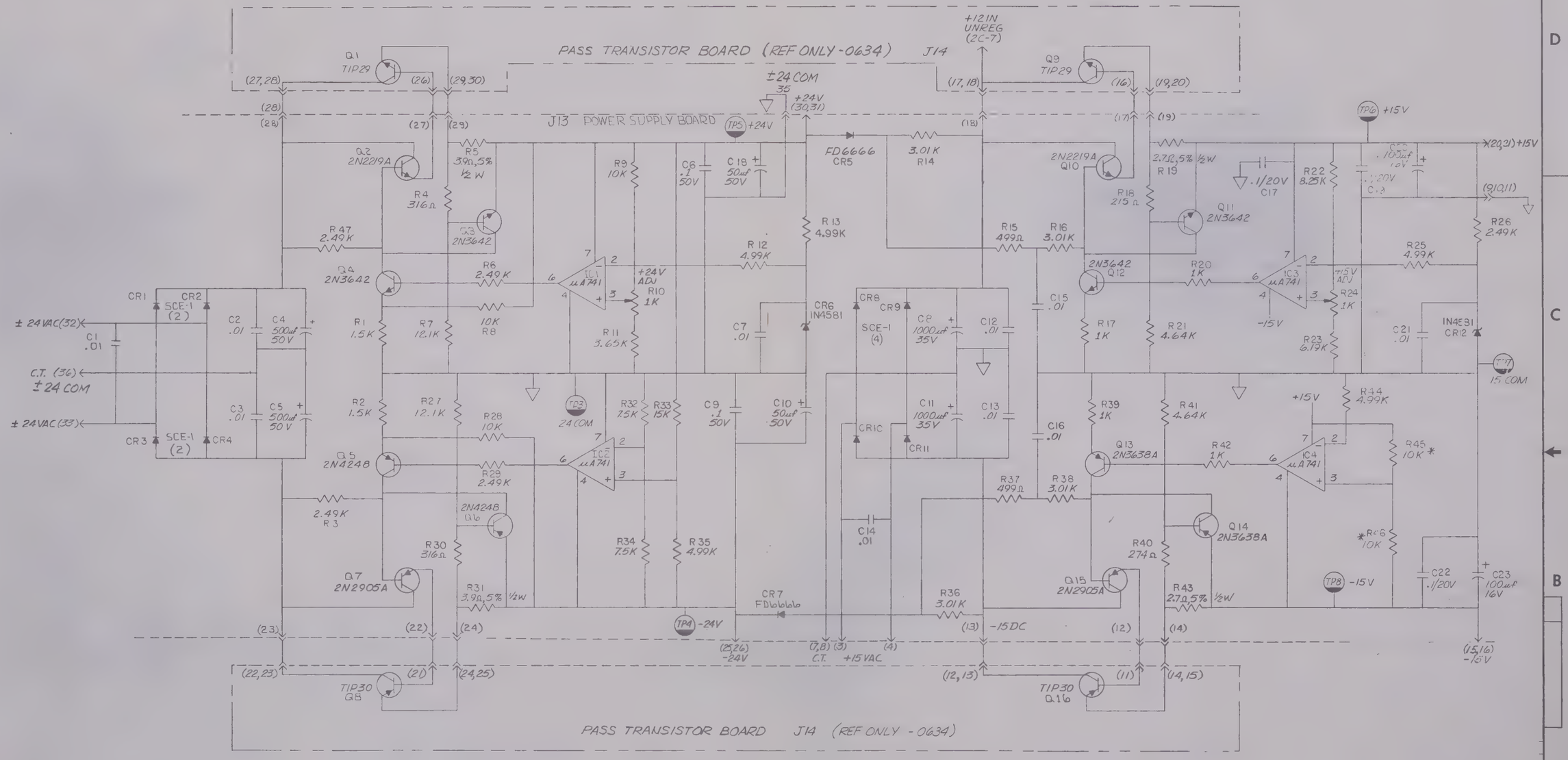
REV	ECN	BY	DATE	APP
A	ENG IMPRV	TLF	8/2/77	



SUPPLY	I LIMIT
+15	500 MA.
-15	560 MA.

LAST REF DES USED
C41
CR16
R62
IC8
Q19
TP16

2 * MATCHED SET OF 10K #
1. ALL CAPACITANCE IS IN MICROFARADS
NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-8-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR BP	SEP 7 '77	TITLE: SCHEMATIC - POWER SUPPLY
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		
	SCALE		

MODEL NO	DWG NO	REV
172A	0103-00-0633	A
CODE IDENT 23338	SHEET 1 OF 2	

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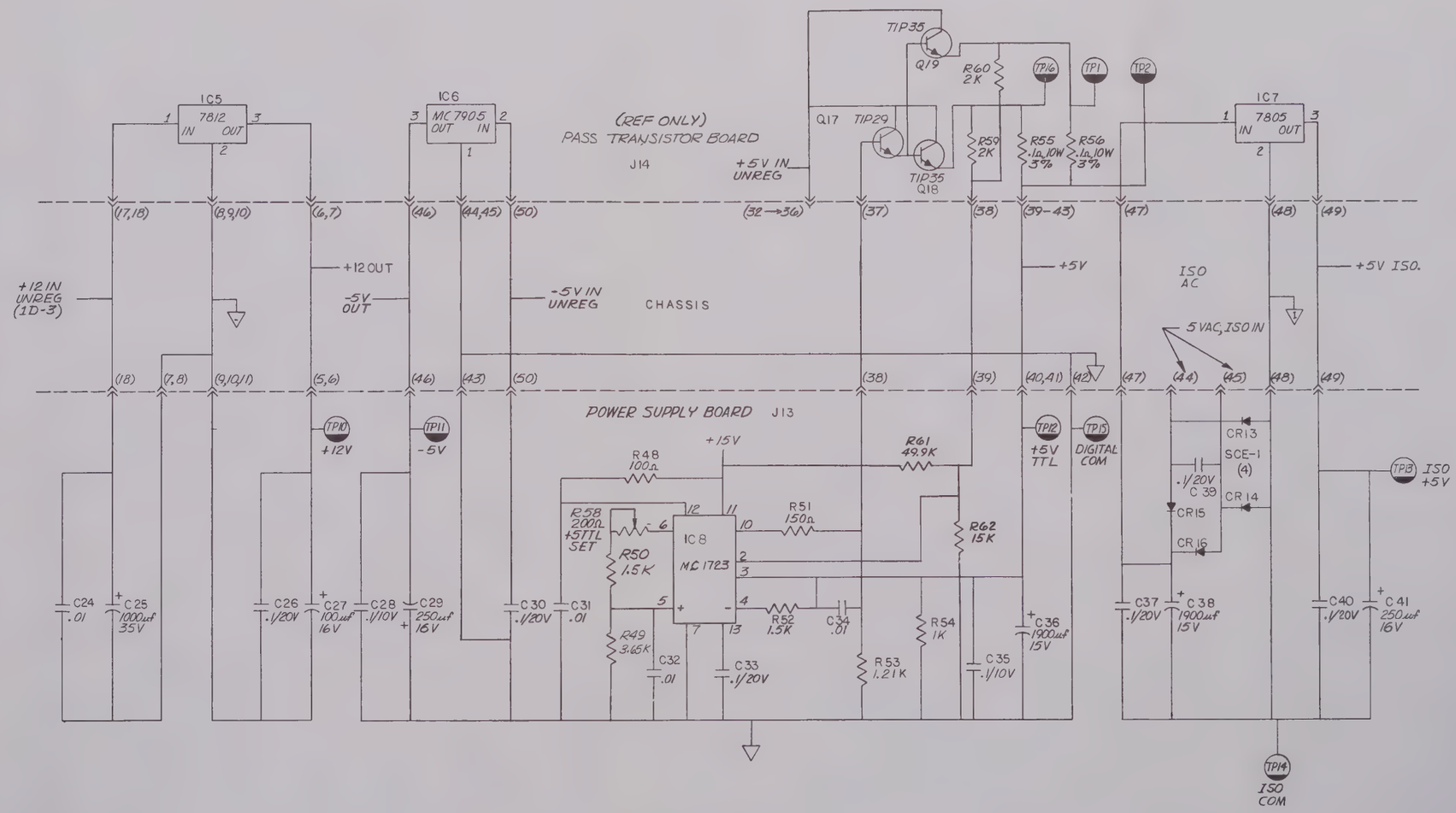
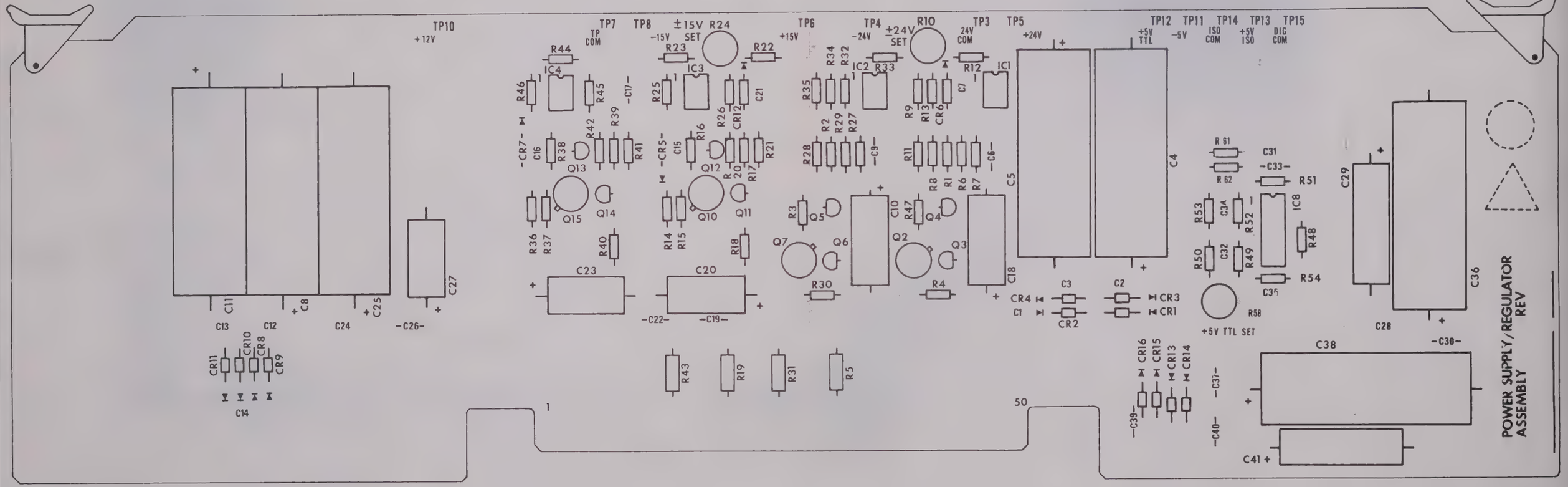
REV	ECN	BY	DATE	APP



NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-9-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL —	PROJ ENGR Tom Saliga	SEPT 7'77	TITLE SCHEMATIC – POWER SUPPLY
	RELEASE APPROV		
FINISH WAVETEK PROCESS —	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0103-00-0633 REV A
	SCALE —	CODE IDENT 23338	SHEET 2 OF 2



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: ASSEMBLY POWER SUPPLY REGULATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO: 172A
	DO NOT SCALE DWG		DWG NO: 0101-00-0633
	SCALE		REV
			CODE IDENT 23338
			SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	CMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWNG,POWER SUPP	0101-00-0633	WVTK	0101-00-0633	1
NONE	SCHEMATIC,POWER SUPP	0103-00-0633	WVTK	0103-00-0633	1
C1 C12 C13 C14 C15 C16 C2 C21 C24 C3 C31 C32 C34 C7	CAP,CER,.01MF,50V	CK-103	CML	1500-01-0310	14
C6 C9	CAP,CER,.1MF,50V	CK-104	CML	1500-01-0410	2
C28 C35	CAP,CER,.1MF,10V	UK10-104	AMCU	1500-01-0412	2
C17 C19 C22 C26 C30 C33 C37 C39 C40	CAP,CER,.1MF,20V	UK20-104	AMCU	1500-01-0413	9
C20 C23 C27	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-31-0101	3
C11 C25 C8	CAP,ELECT,1000MF,35V	39D108G035GL6	SPRAG	1500-31-0212	3
C36 C38	CAP,ELECT,1900MF,15V	39D198G015GL4	SPRAG	1500-31-9201	2
C29 C41	CAP,ELECT,250MF,16V	500D257G016DF7	SPRAG	1500-32-5101	2
C10 C18	CAP,ELECT,50MF,50V	500D506G050DD7	SPRAG	1500-35-0003	2
C4 C5	CAP,ELECT,500MF,50V	39D507G050GL4	SPRAG	1500-35-0103	2
NONE	POWER SUPPLY	1700-00-0633	WVTK	1700-00-0633	1
NONE	PIN,MALE	61182-2	AMP	2100-05-0020	12
NONE	PC BD EJECTOR	103 BLACK	CALMK	2800-07-0017	2
NONE	TRANSIPAD	10123A	MFTWS	2800-11-0003	4

WAVETEK PARTS LIST | TITLE PCA,POWER SUPPLY | ASSEMBLY NO. 1100-00-0633 | PAGE: 1 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	CMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R21 R41	RES,MF,1/8W,1%,4.64K	RN55D-4641F	TRW	4701-03-4641	2
R15 R37	RES,MF,1/8W,1%,449	RN55D-4490F	TRW	4701-03-4490	2
R12 R13 R25 R35 R44	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	5
R61	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
R23	RES,MF,1/8W,1%,6.19K	RN55D-6191F	TRW	4701-03-6191	1
R32 R34	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	2
R22	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TRW	4701-03-8251	1
R45 R46	RES,SET,2-10K,1/8W GTY:214/01-03-1002	142-501-6Aa	WVTK	4799-00-0019	1
CR12 CR6	DIODE	1N4581	MICRO	4801-01-4581	2
CR1 CR10 CR11 CR13 CR14 CR15 CR16 CR2 CR3 CR4 CR8 CR9	DIODE	SLE-1	SEMTC	4801-02-0001	12
CR5 CR7	DIODE	FD-6666	FAIR	4807-02-6666	2
Q10 Q2	TRANS	2N2219A	FAIR	4901-02-2191	2
Q15 Q7	TRANS	2N2905A	FAIR	4901-02-9051	2
Q13 Q14	TRANS	2N3638A	FAIR	4901-03-6381	2
Q11 Q12 Q3 Q4	TRANS	2N3642	FAIR	4901-03-6420	4
Q5 Q6	TRANS	2N2484	FAIR	4901-04-2480	2

WAVETEK PARTS LIST | TITLE PCA,POWER SUPPLY | ASSEMBLY NO. 1100-00-0633 | PAGE: 3 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	CMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R10 R24	POT,TRIM,1K	91A1K	BECK	4600-01-0204	2
R58	POT,TRIM,200	91A200	BECK	4600-02-0101	1
R19 R43	RES,C,1/2W,5%,2.7	RC20GF-2R7	STKPL	4700-25-0274	2
R31 R5	RES,C,1/2W,5%,3.9	RC20GF-3R9	STKPL	4700-25-0394	2
R48	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	1
R17 R20 R39 R42 R54	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	5
R28 R8 R9	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	3
R53	RES,MF,1/8W,1%,1.21K	RN55D-1211F	TRW	4701-03-1211	1
R27 R7	RES,MF,1/8W,1%,12.1K	RN55D-1212F	TRW	4701-03-1212	2
R51	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	1
R1 R2 R50 R52	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	4
R33 R62	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	2
R18	RES,MF,1/8W,1%,215	RN55D-2150F	TRW	4701-03-2150	1
R26 R29 R3 R47 R6	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	5
R40	RES,MF,1/8W,1%,274	RN55D-2740F	TRW	4701-03-2740	1
R14 R16 R36 R38	RES,MF,1/8W,1%,3.01K	RN55D-3011F	TRW	4701-03-3011	4
R30 R4	RES,MF,1/8W,1%,316	RN55D-3160F	TRW	4701-03-3160	2
R11 R49	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	2

WAVETEK PARTS LIST | TITLE PCA,POWER SUPPLY | ASSEMBLY NO. 1100-00-0633 | PAGE: 2 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	CMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
IC1 IC2 IC3 IC4	IC	MA-741	FAIR	7000-07-4100	4
IC5	IC	MC1723CF	MOT	7000-17-2300	1

WAVETEK PARTS LIST | TITLE PCA,POWER SUPPLY | ASSEMBLY NO. 1100-00-0633 | PAGE: 4 | REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST POWER SUPPLY REGULATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO. 1100-00-0633 / REV A
	SCALE		CODE IDENT 23338 / SHEET OF

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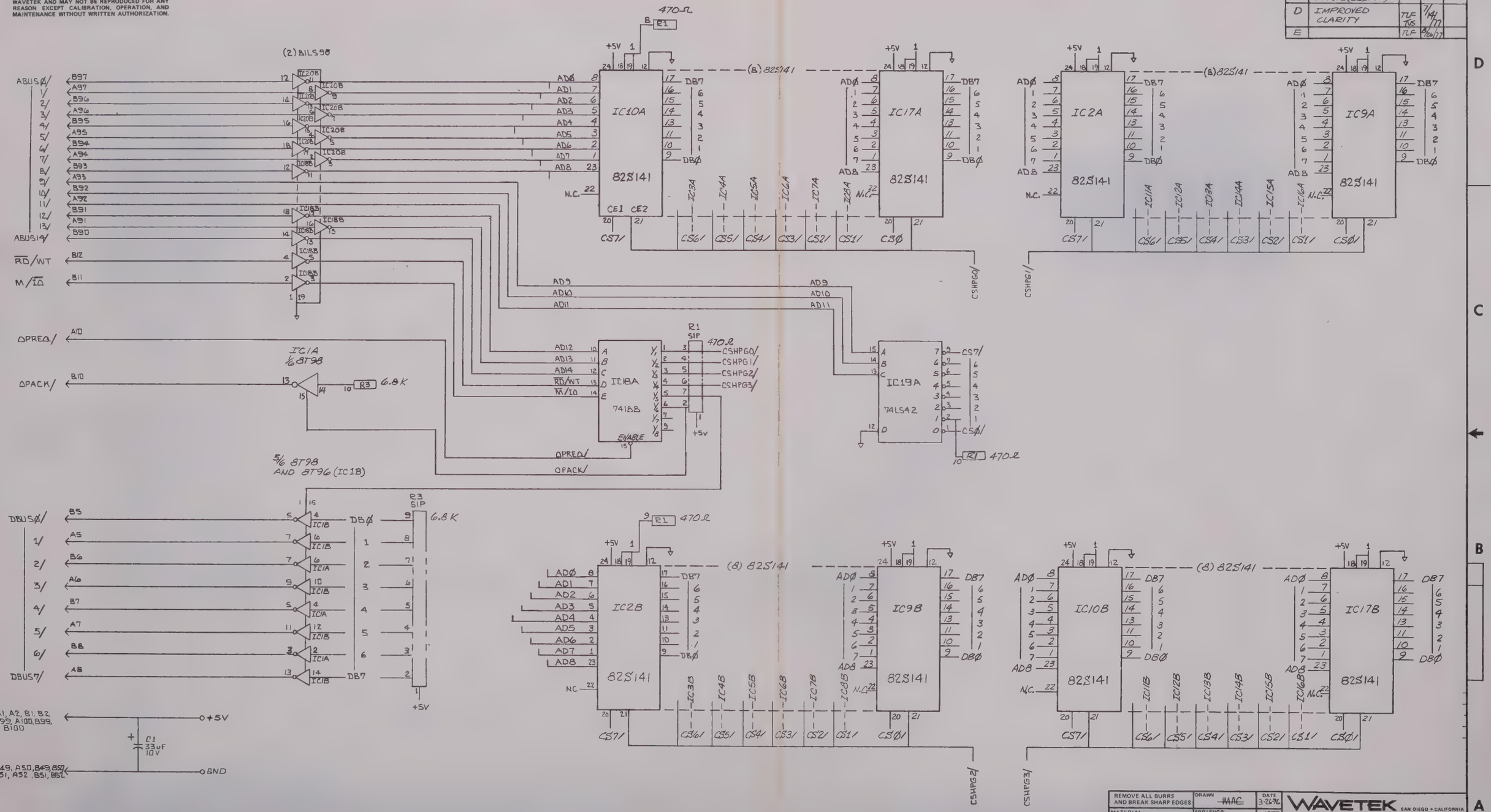
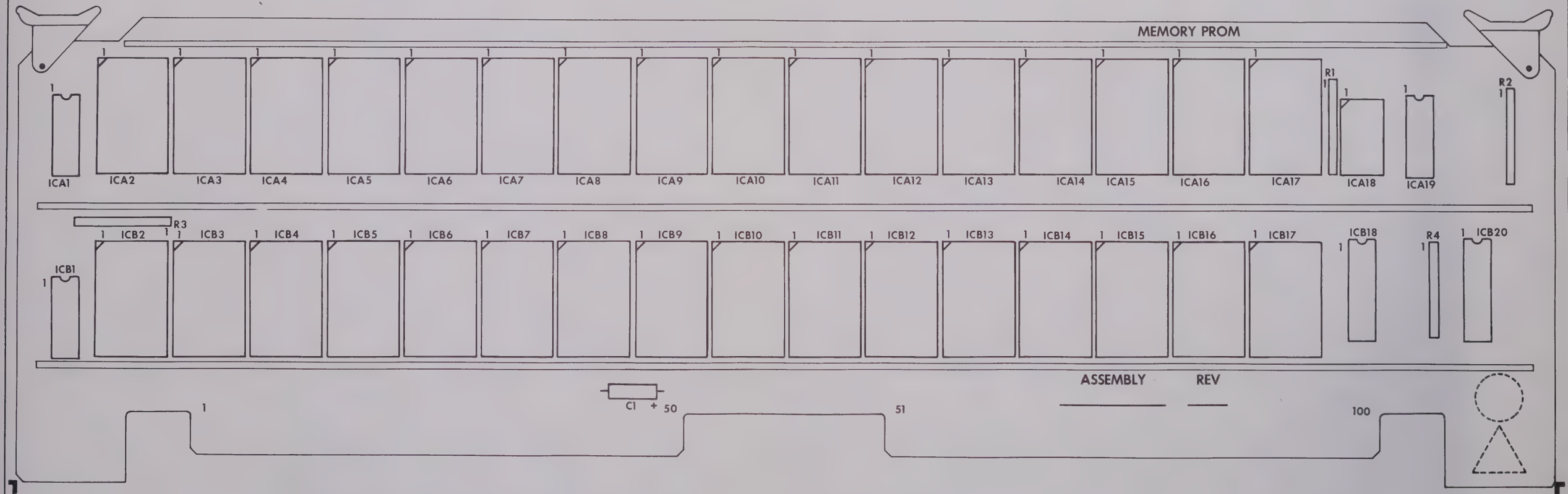
REV	ECN	BY	DATE	APP
C	REVISED TO ACCOMODATE NEW PARTS (825141)	TLF	6/30/77	
D	IMPROVED CLARITY	TLF TWS	7/14/77	
E		TLF	8/26/77	



NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN MAC	DATE 3-24-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROTENGR Tom Solga	1977 26 Aug	TITLE SCHEMATIC — MEMORY PROM
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A · DWG NO 0103-00-0494 · REV E
	SCALE —		CODE IDENT 23338 · SHEET 1 OF 1



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY MEMORY PROM ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0494 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,MEM PROM	0101-00-0494	WVTK	0101-00-0494	1
NONE	SCHEMATIC,MEM PROM	0103-00-0494	WVTK	0103-00-0494	1
C1	CAP,TANT,33MF,10V	150D336X9010B2	SPRAG	1500-73-3601	1
NONE	MEMORY PROM	1700-00-0494	WVTK	1700-00-0494	1
NONE	SKT,IC,16PIN	DIL8-16P-108	BURND	2100-03-0028	1
NONE	SKT,IC,24PIN	DIL8-24P-108	BURND	2100-03-0029	25
NONE	PC BD EJECTOR	103 WHITE	CALMK	2800-07-0008	2
R1	RES MODULE	4310R-101-471	BOURN	4770-00-0009	1
R3	RES MODULE	4310R-101-682	BOURN	4770-00-0016	1
NONE	POWER BUSS BAR (LG)	6009-90-0004	WVTK	6009-90-0004	2
NONE	POWER BUSS BAR (ST)	6009-90-0005	WVTK	6009-90-0005	1
IC81	IC	8T96	SIG	8000-08-9600	1
IC41	SIG	8T98	SIG	8000-08-9800	1
IC419	IC	74LS42B	SIG	8000-74-4210	1
IC818 IC820	IC	DM81LS98N	NSC	8000-81-9810	2

WAVETEK PARTS LIST	TITLE PCA,MEMORY PROM	ASSEMBLY NO. 1100-00-0494 PAGE: 1	REV E

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST MEMORY PROM
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO 172A / DWG NO. 1100-00-0494 / REV E
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
IC A18	IC,PROGRAMMED PROM:8007-41-8800	8600-00-0015	WVTK	8600-00-0015	1
IC A17	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0094	WVTK	8600-00-0094	1
IC A16	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0095	WVTK	8600-00-0095	1
IC A15	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0096	WVTK	8600-00-0096	1
IC A14	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0097	WVTK	8600-00-0097	1
IC A13	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0098	WVTK	8600-00-0098	1
IC B17	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0100	WVTK	8600-00-0100	1
IC B16	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0101	WVTK	8600-00-0101	1
IC B15	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0102	WVTK	8600-00-0102	1
IC B14	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0103	WVTK	8600-00-0103	1
IC B13	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0104	WVTK	8600-00-0104	1
IC B11	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0105	WVTK	8600-00-0105	1

WAVETEK PARTS LIST	TITLE PROM PACKAGE	ASSEMBLY NO. 1109-00-0008 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
IC B10	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0106	WVTK	8600-00-0106	1
IC B9	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0107	WVTK	8600-00-0107	1
IC B8	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0108	WVTK	8600-00-0108	1
IC B7	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0109	WVTK	8600-00-0109	1
IC B6	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0110	WVTK	8600-00-0110	1
IC B5	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0111	WVTK	8600-00-0111	1
IC B4	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0112	WVTK	8600-00-0112	1
IC B3	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0113	WVTK	8600-00-0113	1
IC B2	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0114	WVTK	8600-00-0114	1
IC A12	IC,PROGRAMMED PROM:8008-21-4100	8600-00-0127	WVTK	8600-00-0127	1

WAVETEK PARTS LIST	TITLE PROM PACKAGE	ASSEMBLY NO. 1109-00-0008 PAGE: 2	REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST PROM PACKAGE
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		MODEL NO. 172A / DWG NO. 1109-00-0008 / REV B
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	IC,PROGRAMMED FROM:8008-21-4100	8600-00-0117	WVTK	8600-00-0117	1
NONE	IC,PROGRAMMED FROM:8008-21-4100	8600-00-0118	WVTK	8600-00-0118	1

WAVETEK PARTS LIST	TITLE PROM PACKAGE	ASSEMBLY NO. 1109-00-0012 PAGE: 1	REV

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST PROM PACKAGE OPTION 003
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 172A / DWG NO. 1109-00-0012 / REV
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	IC,PROGRAMMED FROM:8008-21-4100	8600-00-0116	WVTK	8600-00-0116	1

WAVETEK PARTS LIST	TITLE PROM PACKAGE	ASSEMBLY NO. 1109-00-0013 PAGE: 1	REV

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST PROM PACKAGE OPTION 006
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		MODEL NO. 172A / DWG NO. 1109-00-0013 / REV
	DO NOT SCALE DWG		CODE IDENT. 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

A12 WRP
ABUSØ/
ABUS1/
ABUS2/
ABUS3/
B5 DBUSØ/
A5 DBUS1/
B6 DBUS2/
A6 DBUS3/
B7 DBUS4/
A7 DBUS5/
B8 DBUS6/
A8 DBUS7/
A28 SYSCLK2 2.5 MHz
ABUSØ/
ABUS4/
ABUS5/
RD/WT
A94 ABUS7/
A11 E/NE
B94 ABUS6/
B11 M/IO

ICA5-11 (1B8) SYSCLK2 2.5MHz
ICB13 2D3
ICB11-5 (2C2) ENACK/
ICA10
74LS20
ICA12
74LS00
ICA5
ICA1 74189
ICA2 74189
SCRATCH PADS
ICA3 LS175
ICA4 74LS151
N/C
ICB5
7438
OPACK/ B10
RES/ B16
SCN/
INTERNAL DATA BUS
D0-0 A46
D1-0 A45
D2-0 A44
D3-0 A43
D4-0 A42
D5-0 A41
D6-0 A40
D7-0 A39
S A38 (SIGN BIT)
ICB9 8T97
ICB1 8T26
ICB2 8T26
74LS04
ICA10 74LS20
ICA11
ICB10 74188
ICA18-7 (2B5)
ICA19-7 (2B5)
ICA21-7 (2B4)
ICA20-7 (2B4)
ICA17-7 (2B6)
ICA16-7 (2B4)
ICA15-7 (2B5)
ICA14-7 (2B6)
ICA6-13 (1D7)
BOPREQ/ (2C3) ICA12-8
MCE/ ICB10-7 (1A6)
BDØ0/
BDØ1/
BDØ2/
BDØ3/
BDØ4/
BDØ5/
BDØ6/
BDØ7/
R5 4.99K
R7
WRP
ICA5 LS04
ICA12 74LS00
ICB3 74LS 109
SCN/
ICB4 74LS161
TC
ICB17-6 (2A3) RDMEM/
BOUT/
BIN/
STSCN/
LSGN/
SPWT/
WE/ ICB17-7 (2A3)
ICA5, LS04
ICA2- (1C5)
SPWT
ADR/
ICB6
ICB7, 8T95
ICB8, 8T95
ICB8
ICA7-11 (2D1)
ICA7-13 (2D1)
ICA7-15 (2D1)
ICA7-17 (2D1)
ICA7-9 (2C1)
ICA7-7 (2C1)
ICA7-5 (2C1)
ICA7-3 (2C1)
A0-0 A37
A1-0 A36
A2-0 A35
A3-0 A34
STRB-0 A33
SYSCLK1 (B29) 5MHz

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 8-5-77	WAVETEK SAN DIEGO + CALIFORNIA
MATERIAL	PROJENGR Tom Salga	SEPT 7'77	TITLE SCHEMATIC MEMORY RAM
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX .030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0103-00-0493 REV E
	SCALE	CODE IDENT 23338	SHEET 1 OF 2

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REV	ECN	BY	DATE	APP

B29 SYSCLK1 5MHz

ICA5 LS04 9 8 SYSCLK1/ 5MHz

R6 4.99K +5V

ICB15 LS161 ICB14 LS161 15 NC

ICB18 81LS98 ICB9 81S97

ERA/

B97 ABUS0/ A97 ABUS1/ B96 ABUS2/ A96 ABUS3/ B95 ABUS4/ A95 ABUS5/ B94 ABUS6/ A94 ABUS7/ B93 ABUS8/ A93 ABUS9/ B92 ABUS10/ A92 ABUS11/

ICB19 81LS98 1&19 AD0 AD1 AD2 AD3 AD4 AD5 AD6 AD7

ICB18 81LS98 AD8 AD9 AD10 AD11

R11 +5V

A27 SYSCLK4 (2B2) ICB16-2(2B3)

EBA/ ICB11-7 (2C3)

A10 OPREQ/ ICA11-5 (2C4)

ICA14 ICA15 ICA16 ICA17 ICA18 ICA19 ICA20 ICA21 2680

DI7 DI6 DI5 DI4 DI3 DI2 DI1 DI0

DO7/ DO6/ DO5/ DO4/ DO3/ DO2/ DO1/ DO0/

MSB LSB

+12V -5V +5V

CE1 WE/ EBA/

ICA13-5 CE1(2C1) ICB17-7(2B3) WE/

DI0/ ICB1-5 (1C7)

DO0/ ICA9-12 (2D1)

CSEL/ ICB17-5(2A3) ICB13-5(2C3)

ICB13 LS74 ICB12 LS174 ICB11 74188

ICA6-11 (1D7) A10-5 (1D5)

REF NC

EBA/ ICB18-19 (2B7)

ENACK/ ICA10-2(1D5)

R8 470 +5V

ICA11 LS04 ICA12 74LS00

OPREQ/ ICA10 (2B8)

BOPREQ/ ICB10-15 (1A6)

ICB13 LS74 ICB12-3 (2D3)

ICB16 LS161 ICA27(2B8) SYSCLK4 6.25 KHz

ICB17 74188 R9 470

ICB12-4(2D3) CSEL/

RDMEM/ ICA6-10 (1B5)

ICA11-9(2C1) ICA7-19(2C1)

WE/ ICA6-4 (1A5) ICA14-12 (2B6)

ECE ECE/ DECE/

ICA11 LS04

RDMEM/ ICB17-6 (2A3)

R1 4.99K ICA21-6 (2B4) DO0/

ICA7 81LS98 ICA9 LS175 ICA8 LS175 ICA12 74LS00

DO1/ DO2/ DO3/ DO4/ DO5/ DO6/ DO7/

BD00/ (1D2) BD01/ (1D2) BD02/ (1D2) BD03/ (1C2) BD04/ (1C2) BD05/ (1C2) BD06/ (1C2) BD07/ (1C2)

RDMEM ICA11

C5 100Pf R2 100, 1/8W

ICA13 MH0026 R3 78.7Ω C4 .1/20V R4 7.5K CE1 ICA14-12 (2B6)

ICA13 NC

TP2 TP3 TP1 TP5 TP4

+12V A3, B3

C1 100uf 16V

+5V A49, A50 A51, A52 B49, B50 B51, B52

C2 33uf 10V

GND A1, A2 B1, B2 A99, A100 B99, B100

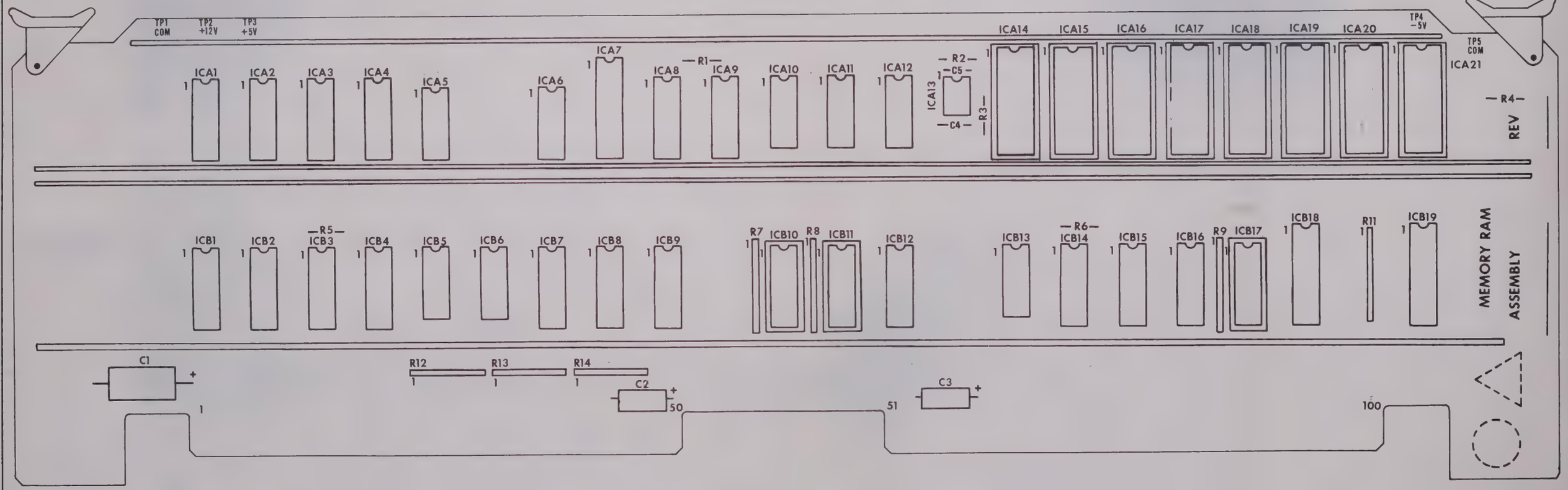
C3 33uf 10V

-5V A53, B53

B91 ABUS12/ A91 ABUS13/ B90 ABUS14/ B12 RD/WT M/IO0

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 8-5-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Seliga	SEPT 7'77	TITLE SCHEMATIC MEMORY RAM
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		
	SCALE		MODEL NO. 172A DWG NO. 0103-00-0493 REV E
			CODE IDENT 23338 SHEET 2 OF 2



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY MEMORY RAM ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO 172A / DWG NO 0101-00-0493 / REV
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	OMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,MEMORY RAM	0101-00-0493	WVTK	0101-00-0493	1
NONE	SCHEMATIC,MEMORY RAM	0103-00-0493	WVTK	0103-00-0493	1
C5	CAP,CER,100PF,1KV	DD-101	CKL	1500-01-0111	1
C4	CAP,CER,.1MF,20V	UK20-104	ARCO	1500-01-0413	1
C1	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-31-0101	1
C2 C3	CAP,TANT,33MF,10V	150D336X9010B2	SPRAG	1500-73-3601	2
NONE	MEMORY RAM	1700-00-0493	WVTK	1700-00-0493	1
NONE	SKT,IC,16PIN	DILR-16P-108	BURND	2100-03-0028	5
NONE	SKT,IC,22 PIN	DILB-22P-108	BURND	2100-03-0035	8
NONE	PIN,MALE	61182-2	AMP	2100-05-0020	5
NONE	PC BD EJECTOR	103 WHITE	CALMK	2800-07-0008	2
R2	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	1
R1 R5 R6	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	3
R4	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	1
R3	RES,MF,1/8W,1%,78.7	RN55D-78R7F	TRW	4701-03-7879	1
R11 R7 R8 R9	RES MODULE	4310R-101-471	BOURN	4770-00-0009	4
NONE	POWER BUSS BAR (LG)	6009-90-0004	WVTK	6009-90-0004	3
NONE	POWER BUSS BAR (ST)	6009-90-0005	WVTK	6009-90-0005	1

WAVETEK PARTS LIST | TITLE PCA,MEMORY RAM | ASSEMBLY NO. 1100-00-0493 | PAGE: 1 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	OMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
ICA15	IC	MMH0026CP1	MOT	8000-00-2600	1
ICB1 ICB2	IC	8126	SIG	8000-08-2600	2
ICB7 ICB8	IC	8T95	SIG	8000-08-9500	2
ICB9	IC	8T97	SIG	8000-08-9700	1
ICA14 ICA15 ICA16 ICA17 ICA18 ICA19 ICA20 ICA21	IC	2680	SIG	8000-26-8000	8
ICA12 ICA6	IC	74LS00	TI	8000-74-0010	2
ICA11 ICA5	IC	74LS04	TI	8000-74-0410	2
ICA10	IC	74LS20	TI	8000-74-2010	1
ICB5 ICB6	IC	7436	TI	8000-74-3800	2
ICB13	IC	74LS74	TI	8000-74-7410	1
ICA7 ICB18 ICB19	IC	DM81LS98N	NSC	8000-81-9810	3
ICB3	IC	74LS109B	SIG	8007-41-0910	1
ICA4	IC	74LS151	TI	8007-41-5110	1
ICB14 ICB15 ICB16 ICB4	IC	74LS161B	SIG	8007-41-6110	4
ICB12	IC	SN74LS174N	TI	8007-41-7410	1
ICA3 ICA8 ICA9	IC	74LS175	TI	8007-41-7510	3

WAVETEK PARTS LIST | TITLE PCA,MEMORY RAM | ASSEMBLY NO. 1100-00-0493 | PAGE: 2 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	OMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
ICA1 ICA2	IC	N74S189A	SIG	8007-41-8900	2
ICB10	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0003	WVTK	8600-00-0003	1
ICB11	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0004	WVTK	8600-00-0004	1
ICB17	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0005	WVTK	8600-00-0005	1

WAVETEK PARTS LIST | TITLE PCA,MEMORY RAM | ASSEMBLY NO. 1100-00-0493 | PAGE: 3 | REV E

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST MEMORY RAM
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A | DWG NO. 1100-00-0493 | REV E
	SCALE		CODE IDENT 23338 | SHEET OF

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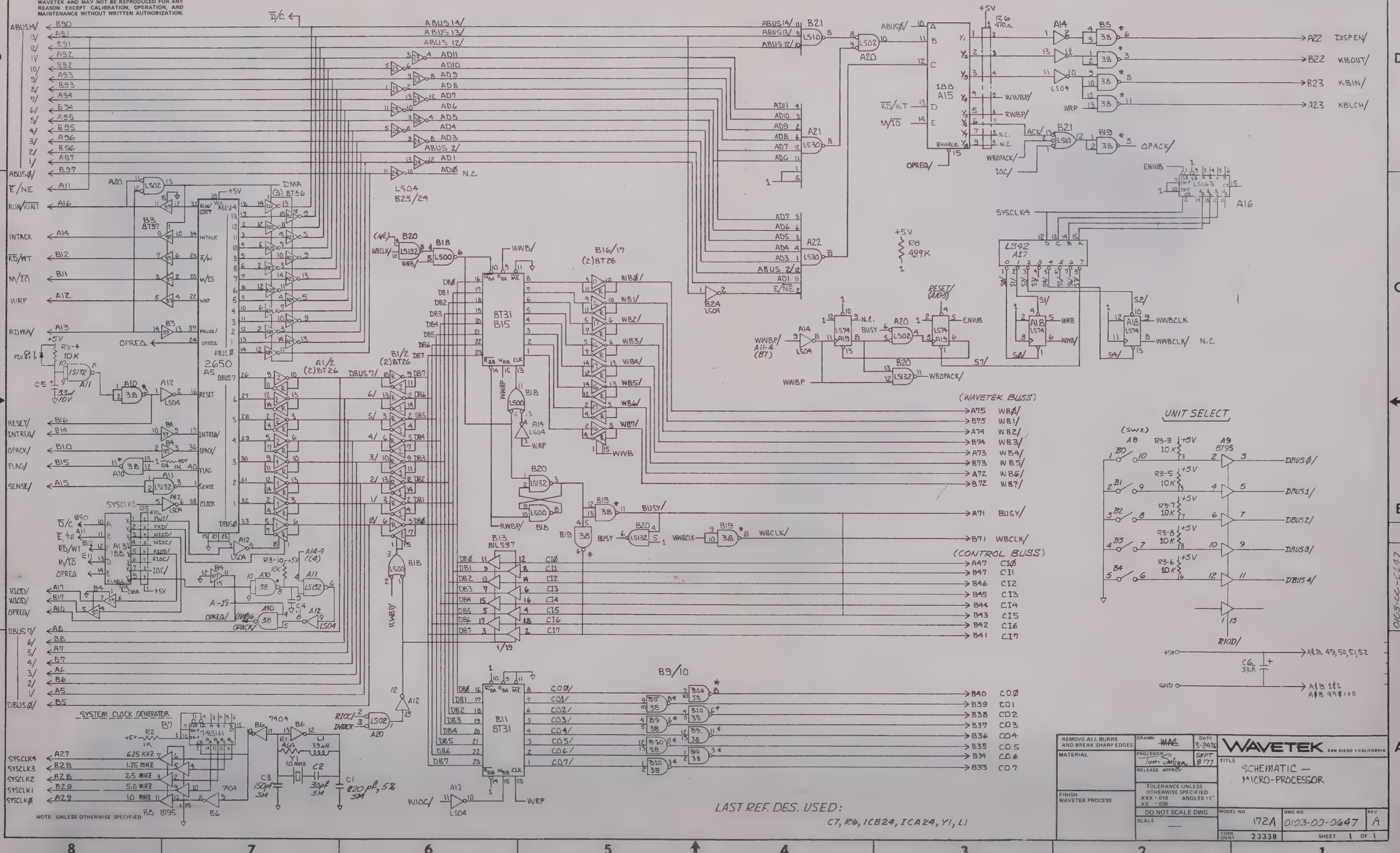
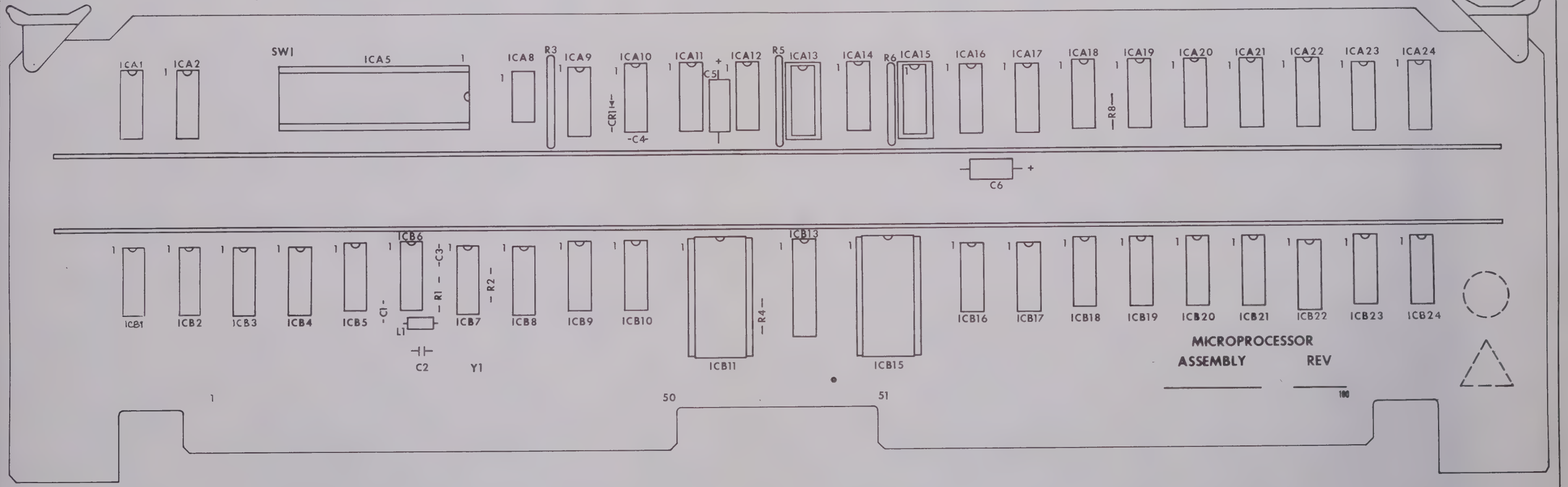
REV	ECN	BY	DATE	APP
A	SW1 OPTIONAL & A21 LOGIC MOD			TJS



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN MAC	DATE 3-24-76	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJENGR Tom Seliger	SEPT 8 '77	TITLE SCHEMATIC — MICRO-PROCESSOR	
	RELEASE APPROV			
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ±1° .XX ± .030			
	DO NOT SCALE DWG		MODEL NO 172A	DWG NO 0103-00-0647 REV A
	SCALE —		CODE IDENT 23338	SHEET 1 OF 1

0103-00-0647



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROTEGR		TITLE: ASSEMBLY MICROPROCESSOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO 172A / DWG NO 0101-00-0647 / REV
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,MPROCESSOR	0101-00-0647	WVTK	0101-00-0647	1
NONE	SCHEMATIC MPROCESSOR	0103-00-0647	WVTK	0103-00-0647	1
C4	CAP,CER,.1MF,10V	UK10-104	ARCO	1500-01-0412	1
C3	CAP,MICA,150PF,500V	DM15-151J	ARCO	1500-11-5100	1
C1	CAP,MICA,220PF,500V	DM15-221J	ARCO	1500-12-2100	1
C2	CAP,MICA,30PF,500V	DM15-300J	ARCO	1500-13-0000	1
C5 C6	CAP,TANT,33MF,10V	1500336X9010B2	SPRAG	1500-73-3601	2
NONE	MICROPROCESSOR	1700-00-0492	WVTK	1700-00-0492	1
L1	CHOKE,39MH	1537-56	DLVAN	1800-00-0003	1
NONE	SKT,IC,16PIN	DILB-16P-108	BURND	2100-03-0028	2
NONE	SKT,IC,24PIN	DILB-24P-108	BURND	2100-03-0029	2
NONE	SKT,IC,40PIN	DILB-40P-108	BURND	2100-03-0030	1
Y1	CRYSTAL,10MHZ	540-502	RTLAB	2300-99-0006	1
NONE	PC BD EJECTOR	103 WHITE	CALMK	2800-07-0008	2
R2 R4	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	2
R1	RES,MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	1
R8	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	1
R3	RES MODULE	4310R-101-103	BOURN	4770-00-0008	1

WAVETEK PARTS LIST	TITLE PCA,MICROPROCESSOR	ASSEMBLY NO. 1100-00-0647 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
ICA17	IC	74LS426	SIG	8000-74-4210	1
ICA18 ICA19	IC	74LS74	TI	8000-74-7410	2
IC813	IC	DM81LS97N	NSC	8000-81-9710	1
ICA11 ICB20	IC	74LS132	TI	8007-41-3210	2
IC87	IC	74LS1618	SIG	8007-41-6110	1
ICA16	IC	74LS163	SIG	8007-41-6310	1
ICA13	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0001	WVTK	8600-00-0001	1
ICA15	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0002	WVTK	8600-00-0002	1

WAVETEK PARTS LIST	TITLE PCA,MICROPROCESSOR	ASSEMBLY NO. 1100-00-0647 PAGE: 3	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R5 R6	RES MODULE	4310R-101-471	BOURN	4770-00-0009	2
CR1	DIODE	FD-6666	FAIR	4807-02-6666	1
SW2	SWITCH PC	500-105	DUNCN	5194-00-0001	1
NONE	POWER BUSS BAR (LG)	6009-90-0004	WVTK	6009-90-0004	2
ICA1 ICA2 ICB1 ICB16 IC817 IC82	IC	8T26	SIG	8000-08-2600	6
ICB11 ICB15	IC	8T31	SIG	8000-08-3100	2
ICA9 ICB8	IC	8T95	SIG	8000-08-9500	2
ICA23 ICA24 ICB22	IC	8T96	SIG	8000-08-9600	3
ICB3 ICB4	IC	8T97	SIG	8000-08-9700	2
ICA5	IC	2650	SIG	8000-26-5000	1
ICB18	IC	74LS00	TI	8000-74-0010	1
ICA20	IC	74LS02	TI	8000-74-0210	1
IC86	IC	7404	TI	8000-74-0400	1
ICA12 ICA14 ICB23 ICB24	IC	74LS04	TI	8000-74-0410	4
ICB21	IC	74LS10	TI	8000-74-1010	1
ICA21 ICA22	IC	74LS30	SIG	8000-74-3010	2
ICA10 ICB10 ICB19 ICB5 IC89	IC	7438	TI	8000-74-3800	5

WAVETEK PARTS LIST	TITLE PCA,MICROPROCESSOR	ASSEMBLY NO. 1100-00-0647 PAGE: 2	REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST MICROPROCESSOR
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 1100-00-0647 / REV A
	SCALE		CODE IDENT 23338 / SHEET OF

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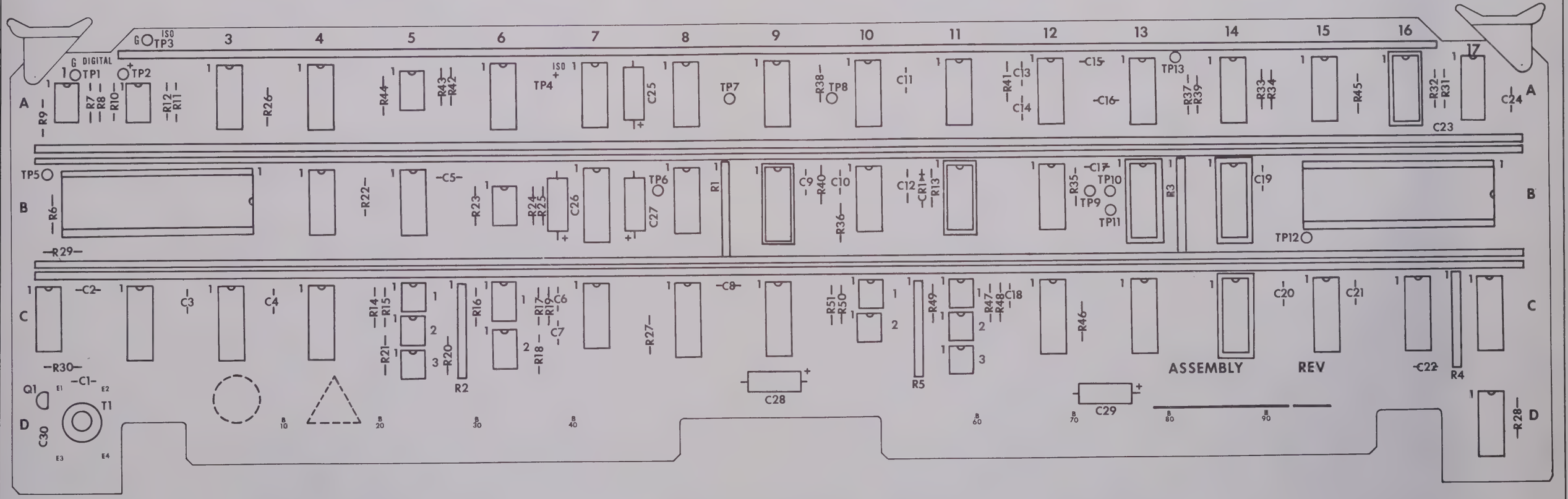
REV	ECN	BY	DATE	APP

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 8-1-77	WAVETEK SAN DIEGO, CALIFORNIA	
MATERIAL —	PROJ ENGR D. BALAN	CHK'D 9/6/77	TITLE SCHEMATIC GPIB INTERFACE	
FINISH WAVETEK PROCESS —	RELEASE APPROV			
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 172A	DWG NO. 0103-00-0643 REV A
	DO NOT SCALE DWG		CODE IDENT 23338	SHEET 1 OF 1
	SCALE —			

NOTE: UNLESS OTHERWISE SPECIFIED



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY GPIB INTERFACE ASSY.
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO 172A / DWG NO 0101-00-0643 / REV
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWNG,INTERFACE	0101-00-0643	WVTK	0101-00-0643	1
NONE	SCHEMATIC,INTERFACE	0103-00-0643	WVTK	0103-00-0643	1
C14	CAP,CER,100PF,1KV	DD-101	CRL	1500-01-0111	1
C1 C11 C15 C16 C17 C18 C19 C2 C20 C21 C22 C23 C24 C3 C30 C4 C5 C6 C7 C8 C9	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	21
C12	CAP,CER,.1MF,20V	UK20-104	AMCO	1500-01-0413	1
C10 C13	CAP,CER,220PF,1KV	DD-221	CRL	1500-02-2111	2
C25 C26 C27 C28 C29	CAP,TANT,33MF,10V	1500336X901082	SPRAG	1500-73-3601	5
NONE	GPIB INTERFACE	1700-00-0643	WVTK	1700-00-0643	1
NONE	SKT,IC,16PIN	DIL8-16P-108	BURND	2100-03-0028	4
NONE	SKT,IC,40PIN	DIL8-40P-108	BURND	2100-03-0030	2
NONE	SOCKET,14 PIN	DIL8-14P-108	BURND	2100-03-0032	2
NONE	PC BD EJECTOR	103 WHITE	CALMK	2800-07-0008	2
T1	CORE	2673002402	FAHIT	3100-00-0007	1
R29	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	1
R13	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	1
R12 R17 R18 R25 R43 R8	RES,MF,1/8W,1%,100K	RN55D-1003F	TRW	4701-03-1003	6

WAVETEK PARTS LIST	TITLE PCA,GPIB INTERFACE	ASSEMBLY NO. 1100-00-0643 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
U2C U3C	IC	8T26	SIG	8000-08-2600	2
U4C U8C	IC	8T97	SIG	8000-08-9700	2
U12C U13C U16C U17C	IC	MC3446P	MOT	8000-34-4600	4
U11B	IC	CD4093BE	RCA	8000-40-9300	1
U15B U1B	IC	IM6402CPL	INTSL	8000-64-0200	2
U13A U1C	IC	74LS04	TI	8000-74-0410	2
U10A	IC	7405	TI	8000-74-0500	1
U17D U5B U7C	IC	74LS05	TI	8000-74-0510	3
U12A	IC	74LS08	TI	8000-74-0810	1
U10B	IC	74LS11	TI	8000-74-1110	1
U12B	IC	74LS32	TI	8000-74-3210	1
U4B	IC	7438	TI	8000-74-3800	1
U14A U15A U17A U4A U8A U8B U9A	IC	74LS74	TI	8000-74-7410	7
U15C	IC	93L24PC	FSC	8000-93-2410	1
U16A	IC	MC14006BCP	MOT	8001-40-0600	1
U11A U3A	IC	74LS132	TI	8007-41-3210	2
U9B	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0090	WVTK	8600-00-0090	1

WAVETEK PARTS LIST	TITLE PCA,GPIB INTERFACE	ASSEMBLY NO. 1100-00-0643 PAGE: 3	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R30	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	1
R10 R16 R19 R23 R44 R9	RES,MF,1/8W,1%,182	RN55D-1820F	TRW	4701-03-1820	6
R11 R24 R42 R7	RES,MF,1/8W,1%,1.96K	RN55D-1961F	TRW	4701-03-1961	4
R40 R41	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	2
R21 R22 R26 R27 R28 R31 R32 R33 R34 R35 R36 R37 R38 R39 R45 R46 R6	RES,MF,1/8W,1%,6.81K	RN55D-6811F	TRW	4701-03-6811	17
R14 R15 R20 R47 R48 R49 R50 R51	RES,MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	8
R1	RES NETWK	785-1R1.5K	BECK	4770-00-0010	1
R2 R3 R4 R5	RES MODULE	4310M-101-682	BOURN	4770-00-0016	4
CR1	DIODE	FD-6666	FAIR	4807-02-6666	1
Q1	TRANS	2N3903	FAIR	4901-03-9030	1
NONE	POWER BUSS BAR (LG)	6009-90-0004	WVTK	6009-90-0004	4
NONE	POWER BUSS BAR (ST)	6009-90-0005	WVTK	6009-90-0005	1
U10C1 U10C2 U11C1 U11C2 U11C3 U5C1 U5C2 U5C3	OPTO-COUPLER	OPI-1643	OPTRO	7000-16-9300	8
U1A U2A U5A U6B U6C1 U6C2	IC	6N136	HP	7100-00-0001	6

WAVETEK PARTS LIST	TITLE PCA,GPIB INTERFACE	ASSEMBLY NO. 1100-00-0643 PAGE: 2	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
U14B	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0091	WVTK	8600-00-0091	1
U13B	IC,PROGRAMMED FROM:8007-41-8800	8600-00-0092	WVTK	8600-00-0092	1
U14C	IC,PROGRAMMED FROM:8008-21-2601	8600-00-0093	WVTK	8600-00-0093	1

WAVETEK PARTS LIST	TITLE PCA,GPIB INTERFACE	ASSEMBLY NO. 1100-00-0643 PAGE: 4	REV A

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST GPIB INTERFACE
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO 172A / DWG NO. 1100-00-0643 / REV A
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

NOTE UNLESS OTHERWISE SPECIFIED

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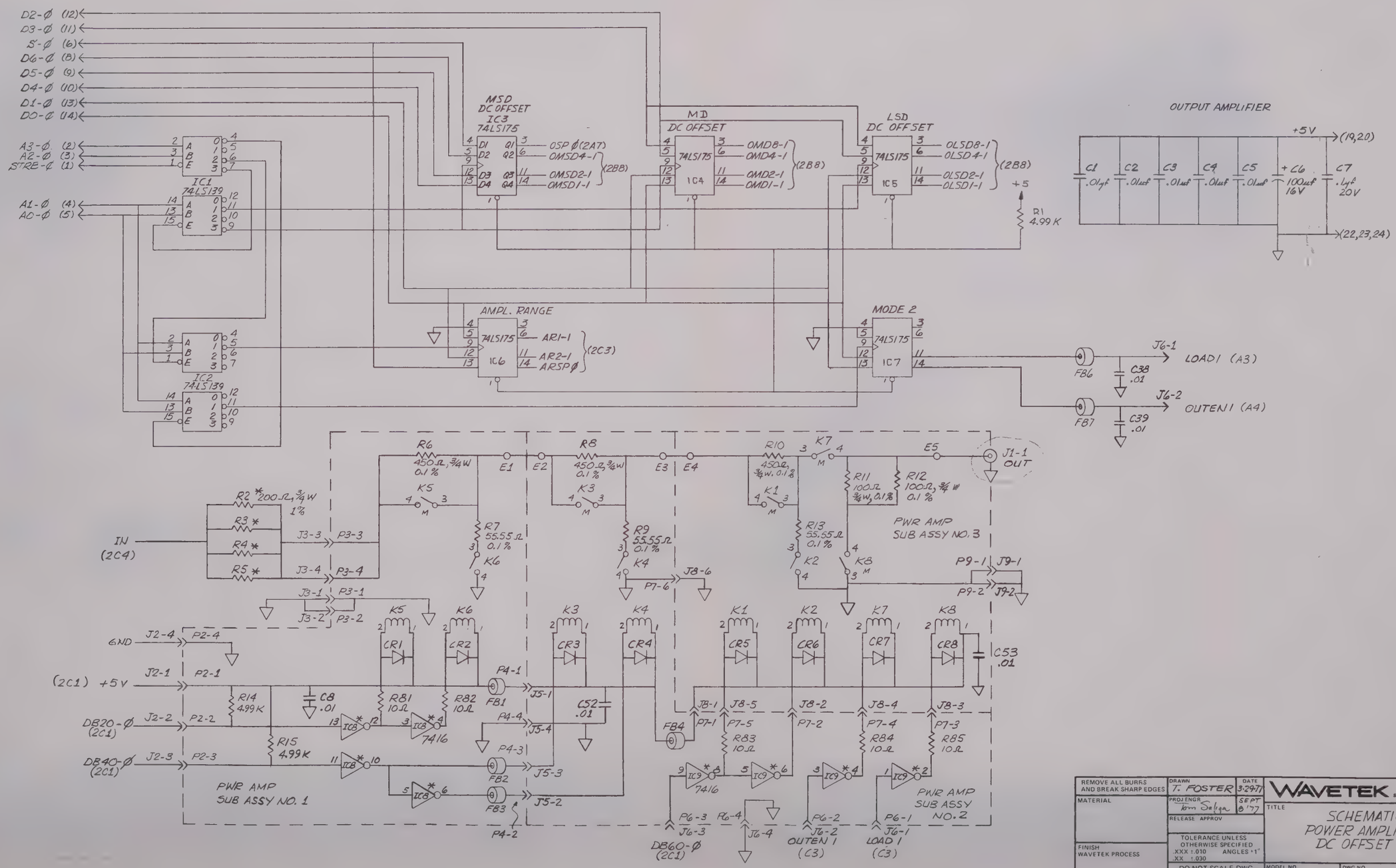
REV	ECN	BY	DATE	APP
A	ADD R86	TLF	6/8/77	



NOTE. UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN T. FOSTER	DATE 3-29-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Selga	SEPT 8 '77	TITLE SCHEMATIC POWER AMPLIFIER DC OFFSET
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0103-00-0590 REV B
	SCALE	CODE IDENT 23338	SHEET 1 OF 2

0103-00-0592

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REV	ECN	BY	DATE	APP

OUTPUT POWER AMP.

(39,40) +24V FB12 C9 .1 50V C10 50µF 50V R16 7.5K R17 2.49K R18 2.49K R19 100 C11 .01 TRIM R20 R21 150 R25 21.5 .1/50V C13 R22 10/5% R23 10/5% 249 R24 Q5 2N2905A NF-207 61.9 R34 2N2219A Q6 R35 61.9 Q7 2N4047 NF-209 C14 .1 50V C15 50 50V CR9 IN4581 R28 499K Q3 2N3903 ABB C12 3.5/13 Pf CR10 CR12 CR11 R30 100 C20 10pf C21 5pf R31 499K R32 2K□ R33 ~GAIN R45 100 CR13 CR15 CR14 R36 249 C22 .01 R37 15 R38 15 R39 15 15 R40 R47 61.9 Q10 2N5160 NF-209 R46 61.9 2N2905A Q9 NF-207 2N3866 Q8 R59 21.5 C27 .1/50V R58 200 TRIM R57 R60 10 5% R61 10 5% C28 .1 50V C29 50 50V TP1 (187) R27 100 Q2 2N5139 C18 .01 C19 .01 R29 49.9K C26 .01 2N5139 Q4 R44 4.99K C25 .01 R55 392 R56 100 -24V C16 .01 R26 15K SIGNAL COMMON (26,27,28,41) Q1 2N3638A R41 24.9K C17 33Pf IC10 CA 3096AE R52 499 R53 PWR AMP OFFSET 20 R54 7.5K R42 499 R43 33.2 .1 50V C23 C24 50µf 50V -24V (36,37) FB5 ATTN. OUT

+5 +15V C30 100,16V +15V (33,34) +15V DACMON (21A) DACMON D-C GAIN R62 - 200 TP4 R63 10K DACMON(B8) R64 △ 10K R65 10K △ R66 59 C31 .01 TP2 R80 10K OFSMON (A8) OFSMON (21B) (IC3) OMSD4-1 OMSD2-1 OMSD1-1 (IC4) OMD8-1 OMD4-1 OMD2-1 OMD1-1 (IC5) OLSD8-1 OLSD4-1 OLSD2-1 OLSD1-1 MSB LSB D-C OFFSET D/A IC11 AD563J IC12 741 .1/20V C32 R67 1M R68 4.99K C33 .1/20V -15V R73 10 R74 10 C36 100 16V C37 .1/20V OFFSET ZERO TP4 R75 100K IC13 741 R69 100K 2N5462 Q11 R70 4.99K C34 .01 C35 .01 R71 4.99K 10K OFFSET ZERO R72 TP2 R76 15K CR16 IC15 7416 R77 15K R78 15K IC15 CR17 Q12 2N5462 R79 100K OSP∅ (IC5)

DC OFFSET

+5V R86 4.99K (IC5) ARSP∅ (IC5) AR2-1 (IC5) AR1-1 +5V IC14 74LS03 FB8 FB9 FB10 FB11 C40 .01 C41 .01 C42 .01 C43 .01 J6-3 D8L0-∅ (1A4, J2-1 (1A7) J2-3 D8A0-∅ (1A7) J2-2 D820-∅ (1A7)

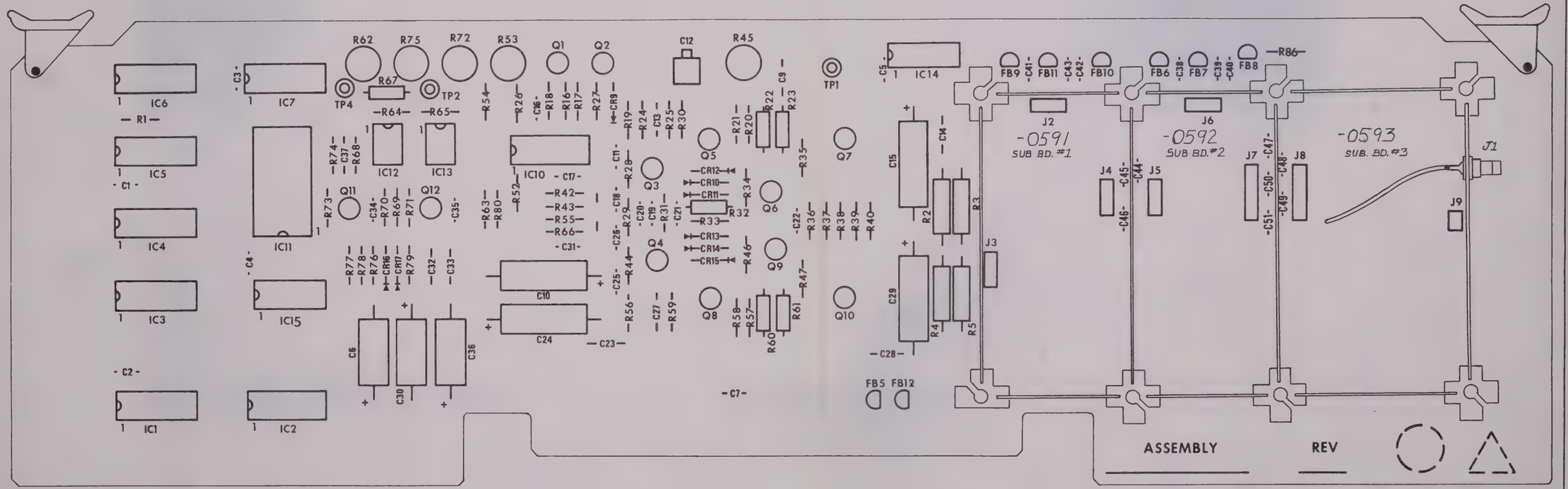
J4-1 J5-1 C44 .01 J4-2 J5-2 C45 .01 J4-3 J5-3 C46 .01 J7-1 J8-1 C47 .01 J7-2 J8-2 C48 .01 J7-3 J8-3 C49 .01 J7-4 J8-4 C50 .01 J7-5 J8-5 C51 .01

LAST REF DES. USED:
C53
CR17
K8
IC14
Q12
R86
FB12
P10
J9
TP4
E6

1. ALL RESISTORS IN OHMS 1/8W, 1%
2. ALL CAPACITORS IN MICROFARADS
3. □ = 0.1% 1/8W RES.
4. △ MATCHED SET # 4789-00-0017
5. ALL UNMARKED DIODES - FD6666

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN T. FOSTER	DATE 3.2477	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR Tom Soliga	SEPT 8 '77	TITLE SCHEMATIC POWER AMPLIFIER DC OFFSET
FINISH WAVETEK PROCESS	RELEASE APPROV	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 .XX ±.030 ANGLES ±1°	
	DO NOT SCALE DWG	SCALE	MODEL NO. 172A · DWG NO 0103-00-0590 · REV B
			CODE IDENT 23338 · SHEET 2 OF 2



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJENGR		TITLE: ASSEMBLY POWER AMPL/DC OFFSET ASSY.
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A
	SCALE		DWG NO 0101-00-0590 REV
			CODE IDENT 23338 SHEET OF

REV	ECN	BY	DATE	APP

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG PWR AMPL	0101-00-0590	WVTK	0101-00-0590	1
NONE	SCHEMATIC PWR AMPL	0103-00-0590	WVTK	0103-00-0590	1
1	PWR AMPL SUB ASSY #1	172-591	WVTK	1208-00-0591	1
2	PWR AMPL SUB ASSY #2	172-592	WVTK	1208-00-0592	1
3	PWR AMPL SUB ASSY #3	172-593	WVTK	1208-00-0593	1
NONE	SHIELD,RF	1400-00-7091	WVTK	1400-00-7091	2
NONE	SHIELD,RF	1400-00-7101	WVTK	1400-00-7101	2
NONE	SHIELD,RF	1400-00-7111	WVTK	1400-00-7111	2
NONE	SHIELD,RF	1400-00-7121	WVTK	1400-00-7121	1
NONE	SHIELD,RF	1400-00-7131	WVTK	1400-00-7131	1
NONE	COVER,RF SHIELD	1400-00-7143	WVTK	1400-00-7143	1
NONE	X,CORNER POST FROM:3200-02-0004	1400-00-7439	WVTK	1400-00-7439	7
NONE	T,CORNER POST FROM:3200-02-0004	1400-00-7449	WVTK	1400-00-7449	1
NONE	SHIELD,RF	1400-00-7451	WVTK	1400-00-7451	2
C21	CAP,CER,5PF,1KV	DD-050	CWL	1500-00-5011	1
C20	CAP,CER,10PF,1KV	DD-100	CWL	1500-01-0011	1
C1 C11 C16 C18 C19 C2 C22 C25 C28 C3 C31 C34 C6 C8 C9	CAP,CER,.01MF,50V	CK-103	CWL	1500-01-0310	29

WAVETEK PARTS LIST | TITLE PCA,PWR AMPL,OFFSET | ASSEMBLY NO. 1100-00-0590 PAGE: 1 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	TRANSIPAD	10123A	METRS	2800-11-0003	2
NONE	TRANSIPAD	10160	METRS	2800-11-0004	4
NONE	HEATSINK	NF-209	WAKE	2800-11-0008	2
NONE	MOUSETAIL	2829-75-2	RUBTK	2800-12-0005	1
NONE	TAPE,DBL SIDED FOAM	4416-1/16"X 2"	3M	3000-00-0023	2
FB10 FB11 FB12 FB5 FB6 FB7 FB8 FB9	BALUN CORE	2873000902	FAIRIT	3100-00-0002	8
R45	POT,TRIM,100	91AR100	BECK	4600-01-0103	1
R72	POT,TRIM,10K	91AR10K	BECK	4600-01-0315	1
R75	POT,TRIM,100K	91AR100K	BECK	4600-01-0402	1
R53	POT,TRIM,20	91AR20	BECK	4600-02-0000	1
R62	POT,TRIM,200	91AR200	BECK	4600-02-0101	1
R22 R23 R60 R61	RES,C,1/2W,5%,10	RC20GF-100	STKPL	4700-25-0100	4
R32	RES,MF,1/8W,.1%,2K	RN55E-20018	TRW	4701-02-2001	1
R19 R27 R30 R56	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	4
R63 R64 R65 R80	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	4
R69 R79	RES,MF,1/8W,1%,100K	RN55D-1003F	TRW	4701-03-1003	2
R73 R74	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	2

WAVETEK PARTS LIST | TITLE PCA,PWR AMPL,OFFSET | ASSEMBLY NO. 1100-00-0590 PAGE: 3 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R67	RES,MF,1/4W,1%,1M	RN60D-1004F	TRW	4701-13-1004	1
R2 R3 R4 R5	RES,MF,3/4W,.1%,200	ML212-200	CADDO	4799-00-0047	4
CR9	DIODE	1N4581	MICRO	4801-01-4581	1
CR10 CR11 CR12 CR13 CR14 CR15 CR16 CR17	DIODE	FD-6616	FAIR	4807-02-6616	8
Q6	TRANS	2N2219A	FAIR	4901-02-2191	1
Q5 Q9	TRANS	2N2905A	FAIR	4901-02-9051	2
Q1	TRANS	2N3638A	FAIR	4901-03-8381	1
Q8	TRANS	2N3866	MOT	4901-03-8660	1
Q3	TRANS	2N3903	FAIR	4901-03-9030	1
Q7	TRANS	2N4047	FAIR	4901-04-0470	1
Q2 Q4	TRANS	2N5139	FAIR	4901-05-1390	2
Q10	TRANS	2N5160	MOT	4901-05-1400	1
Q11 Q12	TRANS	2N5462	NSC	4901-05-4620	2
NONE	CABLE,COAX,26AWG	RG 174/U	ITT	6001-40-0001	1
IC11	IC	AD563J	ANDEV	7000-05-6300	1
IC12 IC13	IC	MA-741	FAIR	7000-07-4100	2
IC10	IC	CA-3096AE	RCA	7000-30-9600	1

WAVETEK PARTS LIST | TITLE PCA,PWR AMPL,OFFSET | ASSEMBLY NO. 1100-00-0590 PAGE: 5 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C5 C50 C51					
C13 C14 C23 C27 C28 C9	CAP,CER,.1MF,50V	CK-104	CWL	1500-01-0410	6
C32 C33 C37 C7	CAP,CER,.1MF,20V	UK20-104	AVCO	1500-01-0413	4
C17	CAP,CER,33PF,1KV	DD-330	CWL	1500-03-3011	1
C30 C36 C6	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-31-0101	3
C10 C15 C24 C29	CAP,ELECT,50MF,50V	500D506G050DD7	SPRAG	1500-35-0003	4
C12	CAP,VAR,3.5-13PF250V	300422-411	TRIKO	1500-51-3010	1
NONE	PWR AMPL,OFFSET BD	1700-00-0590	WVTK	1700-00-0590	1
NONE	SKT,IC,24PIN	DILB-24P-108	BURND	2100-03-0029	1
NONE	TERM	2010B1	USECO	2100-05-0011	12
TP1 TP2 TP4	CONN	60598-8	AMP	2100-05-0017	3
4	CONN PIN,MALE U04-EA PIN	CAS36SP-100-230-730	CA	2100-05-0031	34
NONE	CONN	27-843	AMPH	2100-07-0009	1
J1	CONN	27-3	AMPH	2100-07-0012	1
4	PC BD EJECTOR	103 GRAY	CALMK	2800-07-0016	2
NONE	HEAT SINK	NF-207	WAKE	2800-11-0001	2

WAVETEK PARTS LIST | TITLE PCA,PWR AMPL,OFFSET | ASSEMBLY NO. 1100-00-0590 PAGE: 2 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R33	RES,MF,1/8W,1%,12.1K	RN55D-1212F	TRW	4701-03-1212	1
R21	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	1
R26 R76 R77 R78	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	4
R37 R38 R39 R40	RES,MF,1/8W,1%,15	RN55D-15R0F	TRW	4701-03-1509	4
R58	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	1
R25 R59	RES,MF,1/8W,1%,21.5	RN55D-21R5F	TRW	4701-03-2159	2
R24 R36	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	2
R17 R18	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	2
R41	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	4701-03-2492	1
R43	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	1
R55	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	1
R42 R52	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	2
R1 R28 R31 R44 R68 R70 R71 R86	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	8
R29	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
R66	RES,MF,1/8W,1%,59	RN55D-59R0F	TRW	4701-03-5909	1
R34 R35 R46 R47	RES,MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	4
R16 R54	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	2

WAVETEK PARTS LIST | TITLE PCA,PWR AMPL,OFFSET | ASSEMBLY NO. 1100-00-0590 PAGE: 4 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
IC14	IC	74LS03	TI	8000-74-0310	1
IC15	IC	7416	SIG	8000-74-1600	1
IC1 IC2	IC	74LS1398	SIG	8007-41-3910	2
IC3 IC4 IC5 IC6 IC7	IC	74LS175	TI	8007-41-7510	5

WAVETEK PARTS LIST | TITLE PCA,PWR AMPL,OFFSET | ASSEMBLY NO. 1100-00-0590 PAGE: 6 | REV B

NOTE UNLESS OTHERWISE SPECIFIED

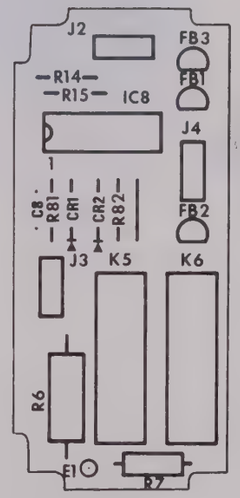
REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE
MATERIAL	PROJENGR	
	RELEASE APPROV	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX : 010 ANGLES ±1° XX : 030	
	DO NOT SCALE DWG	
	SCALE	

WAVETEK SAN DIEGO • CALIFORNIA

TITLE: PARTS LIST POWER AMPLIFIER/ DC OFFSET

MODEL NO. 172A | DWG NO. 1100-00-0590 | REV B

CODE IDENT 23338 | SHEET OF



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY POWER AMPLIFIER SUB. ASSY. NO. 1
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0591 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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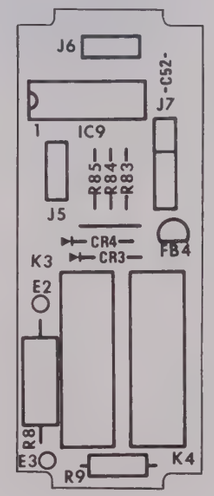
REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRVG PWR AMPL#1	0101-00-0591	WVTK	0101-00-0591	1
NONE	SCHEMATIC PWR AMPL	0103-00-0590	WVTK	0103-00-0590	1
C8	CAP,CER,.01MF,50V	CK-103	CML	1500-01-0310	1
NONE	PWR AMPL BD #1	1700-00-0591	WVTK	1700-00-0591	1
P2 P3 P4	CONN	22-17-2042	MOLEX	2100-02-0065	3
FB1 FB2 FB3	BALUN CORE	2873000902	FARIT	3100-00-0002	3
K6	RELAY,RED,FORM-A	RA3019-1051	ETROL	4500-00-0007	1
K5	RELAY,FORM A MERCURY	4500-00-0012	WVTK	4500-00-0012	1
R7	RES,MF,1/8W,.1%,55.5	RN55E55R5B	TRW	4701-02-5559	1
R81 R82	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	2
R14 R15	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	2
R6	RES,MF,3/4W,.1%,450	ML212-450	CADDO	4799-00-0046	1
CR1 CR2	DIODE	FD-6666	FAIR	4807-02-6666	2
NONE	WIRE,WIREWRAP 24GA. KYNAR INSULATION	UL1422 W/W WIRE WMT	BRDRX	6000-52-4009	1
IC8	IC	7416	SIG	8000-74-1600	1

WAVETEK PARTS LIST	TITLE PWR AMPL SUB ASSY #1	ASSEMBLY NO. 1208-00-0591 PAGE 1	REV B

NOTE. UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST POWER AMPLIFIER SUBASSEMBLY #1
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1 .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 1208-00-0591 / REV B
	SCALE		CODE IDENT 23338 / SHEET OF



WAVETEK MOD.172
SILKSCREEN
POWER AMP SUB ASSY NO.2
0100-00-0592-3

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY POWER AMPLIFIER SUB. ASSY. NO. 2
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0592 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND DESIGN RIGHTS BELONGING TO WAVETEK AND MAY NOT BE REPRODUCED FOR ANY REASON EXCEPT CALIBRATION, OPERATION, AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION.

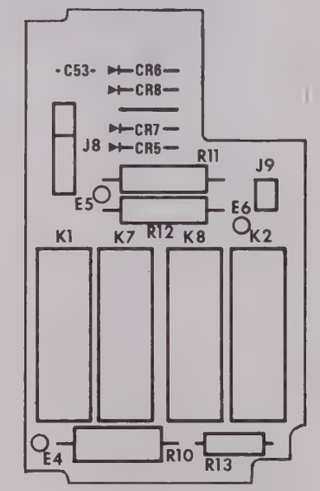
REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG PWR AMPLR2	0101-00-0592	WVTK	0101-00-0592	1
NONE	SCHEMATIC PWR AMPL	0103-00-0590	WVTK	0103-00-0590	1
C52	CAP,CER,.01MF,50V	CK-103 LONG LEAD	CWL	1500-01-0300	1
NONE	PWR AMPL SUB BD #2	1700-00-0592	WVTK	1700-00-0592	1
P7A	CONN	22-17-2022	MOLEX	2100-02-0061	1
P5 P6 P7B	CONN	22-17-2042	MOLEX	2100-02-0065	3
NONE	SPRING SOCKET	50935-1	AMP	2100-03-0059	1
FB4	BALUN CORE	2873000402	FAIRIT	3100-00-0002	1
K4	RELAY,REED,FORM-A	HA3019-1051	ETHOL	4500-00-0087	1
K3	RELAY,FORM A MERCURY	4500-00-0012	WVTK	4500-00-0012	1
R9	RES,MF,1/8W,.1%,55.5	RN55E55R5B	TRW	4701-02-5554	1
R83 R84 R85	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	3
R8	RES,MF,3/4W,.1%,450	ML212-450	CADDO	4799-00-0044	1
CR3 CR4	DIODE	FD-6666	FAIR	4807-02-5666	2
NONE	WIRE,NICHROME 24GA. KYNAR INSULATION	UL1422 KYN NICKEL WHT	BRDNA	6000-52-4004	1
IC9	IC	741E	SIG	8000-74-1600	1

WAVETEK PARTS LIST	TITLE PWR AMPL SUB ASSY #2	ASSEMBLY NO. 1209-00-0592 PAGE: 1	REV C

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR		TITLE PARTS LIST POWER AMPLIFIER SUBASSEMBLY #2
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		
	SCALE		MODEL NO 172A / DWG NO 1209-00-0592 / REV C
			CODE IDENT 23338 / SHEET OF



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: ASSEMBLY POWER AMPLIFIER SUB ASSY. NO. 3
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO 172A / DWG NO 0101-00-0593 / REV
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG PWR AMPL#3	0101-00-0593	WVTK	0101-00-0593	1
NONE	SCHEMATIC PWR AMPL	0103-00-0590	WVTK	0103-00-0590	1
C53	CAP,CER,.01MF,50V	CK-103 LONG LEAD	CHL	1500-01-0300	1
NONE	PWR AMPL BD #3	1700-00-0593	WVTK	1700-00-0593	1
P8A P9	CONN	22-17-2022	MOLEX	2100-02-0061	2
P8B	CONN	22-17-2042	MOLEX	2100-02-0065	1
NONE	SPRING SOCKET	50935-1	AMP	2100-03-0039	2
K2	RELAY,REED,FORM-A	RA3019-1051	ETHOL	4500-00-0007	1
K1 K7 K8	RELAY,FORM A MERCURY	4500-00-0012	WVTK	4500-00-0012	3
R13	RES,MF,1/8W,.1%,55.5	RN55E55R5B	TRW	4701-02-5559	1
R11 R12	RES,MF,3/4W,.1%,100	ML212-100	CADDU	4799-00-0038	2
R10	RES,MF,3/4W,.1%,450	ML212-450	CADDU	4799-00-0046	1
CR5 CR6 CR7 CR8	DIODE	FD-6666	FAIR	4807-02-6666	4
NONE	WIRE,RIBBONAP 24GA. KYNAR INSULATION	UL1422 W/W WIRE WHT	BRONX	6000-52-4009	1

WAVETEK PARTS LIST	TITLE PWR AMPL SUB ASSY #3	ASSEMBLY NO. 1208-00-0593 PAGE: 1	REV C

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST POWER AMPLIFIER SUBASSEMBLY #3
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 172A / DWG NO. 1208-00-0593 / REV C
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

PRE-AMP OUT (D8)

PRE-AMP OUT(48,49) ← PRE-AMP. OUT (D5)

D4-Ø (10A)
D5-Ø (9A)
D7-Ø (7A)
D6-Ø (8A)

IC1 74LS175 AMPLITUDE MSD

D1-Ø (3A)
D3-Ø (11A)
D2-Ø (12A)
D0-Ø (14A)

IC2 74LS175 MD

IC3 74LS175 LSD

+5V (19,20)
COMMON (22,23,24)
FB FB
C6 .001
C7 .001
C8 .01

A2-Ø (3A)
A3-Ø (2A)
STRB (1A)

IC4 74LS139

A1-Ø (4A)
A0-Ø (5A)

IC4 74LS139

+5V
R1 4.99K

C1 .01
C2 100 / 16V

A8-0
A4-0
A2-0
A1-0

74LS00 IC5

A0.4-1
A0.2-0
A0.2-1
A0.1-0

IC5

IC5

A0.04-1
A0.02-0
A0.02-1
A0.01-0

74LS05 (4)

CR1 CR2 K2 CR3 CR4 K4 CR5 CR6 K6 CR7 CR8 K8 CR9 K10 CR10 CR11 CR12 K12 CR13 K14 CR14 CR15 CR16 K16 CR17 K18 CR18 CR19 CR20 K20 CR21 K22 CR22 CR23 CR24 K24

C3 .01uF
C4 .01uf
C5 .01uf

K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 K17 K18 K19 K20 K21 K22 K23 K24

R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R26 3K .1% R27 3K .1% R24 R25 R28 1.5K R29 1.5K R30 1.5K R31 1.5K R32 3.01K R33 3.01K

IC6-6 IC6-4 IC6-2 IC7-6 IC7-10 IC7-2 IC8-8 IC8-4 IC8-12 IC9-6 IC9-10 IC9-2

R34 3K .1%
R35 30.1K
R36 3K .1%

J1 ATTEN OUT

(26,27,28) PWR COM

(43,44,45,46) SIG IN COM

RA3019-1051 FORM RELAY (24)

R11 THRU R25 Δ 750Ω .1% (15 EA)
R2 THRU R10 * 750Ω .1% (9 EA) MATCHED SET (REF: 4789-00-0042)

TRUTH TABLE

A3-1	A2-1	A1-1	A0-1	C7-D4	D3-D0
1	0	0	0	MSD	MMD
1	0	0	1	LSD	

LAST REF DES USED
C8
CR24
K24
IC9
R36
J1

1. ALL UNMARKED DIODES ARE FD6666 (24)
NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS

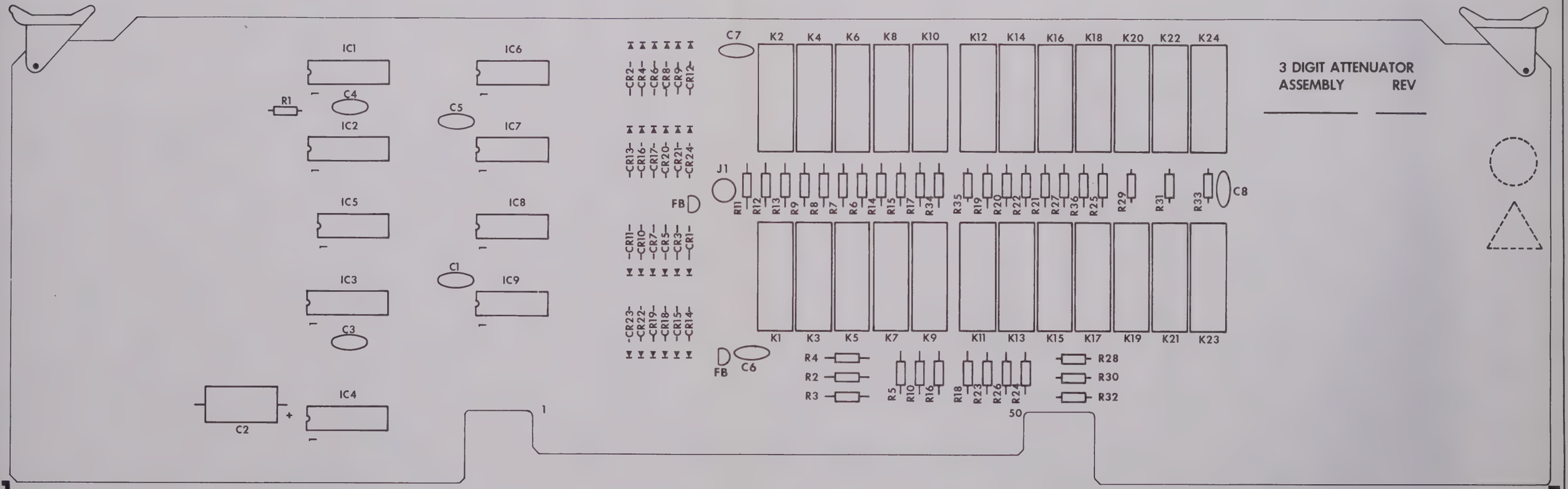
DRAWN Ro Fifer DATE 6-7-6
PROJENGR Tom Selga SEPT 8'77
RELEASE APPROV

TOLERANCE UNLESS OTHERWISE SPECIFIED
XXX ±.010 ANGLES ±1°
XX ±.030
DO NOT SCALE DWG
SCALE

WAVETEK SAN DIEGO • CALIFORNIA

TITLE
3 DIGIT ATTENUATOR SCHEMATIC

MODEL NO. 172A
DWG NO. 0103-00-0638
REV
CODE IDENT 23338
SHEET 1 OF 1



3 DIGIT ATTENUATOR
ASSEMBLY REV

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY 3 DIGIT ATTENUATOR ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0638 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG,3 DIGIT	0101-00-0638	WVTK	0101-00-0638	1
NONE	SCHEMATIC,3 DIGIT	0103-00-0638	WVTK	0103-00-0638	1
C6 C7	CAP,CER,.001MF,1KV	DD-102	CWL	1500-01-0211	2
C1 C3 C4 C5 C8	CAP,CER,.01MF,50V	CK-103	CWL	1500-01-0310	5
C2	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-31-0101	1
NONE	3 DIGIT ATTENUATOR	1700-00-0638	WVTK	1700-00-0638	1
J1	CONN	27-642	AMPH	2100-07-0011	1
NONE	PC BD EJECTOR	103 VIOLET	CALAK	2400-07-0015	2
NONE	BALUN CORE	2673000902	FAIRT	3100-00-0002	2
K10 K11 K12 K13 K14 K15 K16 K17 K18 K19 K2 K20 K21 K22 K23 K24 K4 K5 K6 K7 K8 K9	RELAY,REED,FORM-A	HE3019-1051	ETROL	4500-00-0007	22
K1 K3	RELAY,REED,FORM-C	HE3020-1051	ETROL	4500-00-0009	2
R26 R27 R34 R36	RES,MF,1/8W,.1%,3K	RN55E-3001B	TRW	4701-02-3001	4
R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24 R25	RES,MF,1/8W,.1%,750	RN55E-7500B	TRW	4701-02-7500	15
R28 R29 R30 R31	RES,MF,1/8W,1%,1.5K	RN55C-1501F	TRW	4701-03-1501	4
R32 R33	RES,MF,1/8W,1%,3.01K	RN55D-3011F	TRW	4701-03-3011	2

WAVETEK PARTS LIST	TITLE PCA,3 DIGIT ATTEN.	ASSEMBLY NO. 1100-00-0638 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R35	RES,MF,1/8W,1%,30.1K	RN55D-3012F	TRW	4701-03-3012	1
R1	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	1
R10 R2 R3 R4 R5 R6 R7 R8 R9	RES,SET,9-750,1/8W QTY:9:4701-02-7500	4789-00-0042	WVTK	4789-00-0042	1
CR5 CR1 CR10 CR11 CR12 CR13 CR14 CR15 CR16 CR17 CR18 CR19 CR2 CR20 CR21 CR22 CR23 CR24 CR3 CR4 CR6 CR7 CR8 CR9	DIODE	FD-6666	FAIR	4807-02-6666	24
IC5	IC	74LS00	TI	6000-74-0010	1
IC6 IC7 IC8 IC9	IC	74LS05	TI	6000-74-0510	4
IC4	IC	74LS139	SIG	6007-41-3910	1
IC1 IC2 IC3	IC	74LS175	TI	6007-41-7510	3

WAVETEK PARTS LIST	TITLE PCA,3 DIGIT ATTEN.	ASSEMBLY NO. 1100-00-0638 PAGE: 2	REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST 3 DIGIT ATTENUATOR
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ± .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 1100-00-0638 / REV A
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

SINE CONVERTOR

+15V, -15V, TRIA OUT (25), TP1, R105 10K, R107 20K, SINE OFFSET, R104 10K, RT1 LB12J2, R1 20Ω, R2 21.5, R3 21.5Ω, R4 33.2Ω, SINE DIST, R5 100Ω GAIN, R6 499Ω, C2 TRIM, C1 .1/20V, C3 .1/20V, R11 1K, R12 2K, R13 15K, R7 15K, R8 2K, R9 1K, R14 301Ω, R10 301Ω, Q1 2N3905, Q2 2N3903, SINE DIST

1 SET CR1-CR8 182-500-98

1 SET CR9-CR16 182-500-98

CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9 CR10 CR11 CR12 CR13 CR14 CR15 CR16

R15 12.1K, R16 165K, R17 12.1K, R18 24.9K, R19 1K, R20 165K, R21 1K, R22 13K, R23 392, R24 274, R25 12.1K, R26 165K, R27 12.1K, R28 24.9K, R29 100Ω, C50 33Pf, C4 47Pf

SQUARE WAVE SHAPER

+15V, SQ (18), R30 61.9Ω, R31 15K, Q7 2N3903, R32 100Ω, C6 .01, R33 100Ω, C5 .01, R34 2.49K, R35 2.49K, R36 200Ω, +PEAK, Q3 2N3905, Q4 2N3905, R37 2.21K, C10 .1/20V, C11 100/16V, C51 30Pf (5), R44 2.21K, CR21, CR22, CR17, CR18, FDT771(A), CR19, CR20, R39 2.49K, Q5 2N3903, Q6 2N3903, R38 2.49K, R40 100Ω, R41 2.49K, R42 2.21K, C7 .01, -PEAK, R43 200Ω, -15V, C8 .1/20V, C9 100/16V

INPUT CONTROL LOGIC

"A" SIDE, IC4 74LS139

A1 (4), A0 (5), STRB (1), A3 (2), A2 (3)

AMPL. SIGN, IC3 74LS 74, S(6), R45 4.99K, +5V, IC1 7416, K4, CR30, C12 .1/10V

IC2 74LS175 FUNCTION

D7 (7), D6 (8), D4 (10), D5 (9), F8(90), SQ MODE (B6)

K2, RA 3020-105113, CR27, C13 .1/10V, K1, CR28

IC1, 7416

K3, CR20

INVERTING AMPLIFIER

(33,34) +15V, (26,27,28), (30,31) -15V

K1, K2, K3, C47 .01, R108 499

R46 7.5K, R47 2K, R48 2K, IC5, Q13 2N3565, CR31 130-506, C14, .01, R51 249Ω, R57 1K, R58 68Ω, C15 22Pf, R52 1K, R53 20Ω, R54 4.99K, R55 100Ω, R56 750Ω, C18 .01, R62 15K, R63 10K, R64 100Ω, C19 .01, C17 .01, C21 5Pf, C22 10Pf, CR23, CR24, R61 249Ω, C24 820Pf, C25 .001, Q11 2N3646, Q12 2N3905, R68 10Ω, C48 .1/20V, R67 1.5K, R74 249Ω, C26 .1/20V, R109 316Ω, CR33 HP2811, C29 .1/20V, -15V

R49, 1K SQ MODE (C1), R59 100Ω, R65 1K, R66 10Ω, C23 .1/20V, R72 249Ω, C28 .1/20V, Q8 2N3646, C20 .01, C16 100Pf, Q9 2N3640, R60 10K, Q10 2N3903, C27 .1/20V, R71 10Ω, R70 392Ω, R69 49.9K, R75 10Ω

(19), (20) +5V, C49 100/16V, C45 .01, C46 .01, (22), (23), (24), TP4 COM

K5, CR35 HP2811, +5V, CR34, (F8) 90 IC2-2

NON-INVERTING AMPLIFIER

R75 7.5K, R77 2K, R81 2K, IC6, Q14 2N3565, CR32 130-506, C31, .01, R82 249Ω, R83 1K, R78 1K, C30 22Pf, R79 20Ω, DC OFFSET ADJ, R85 499Ω, R86 237K, R80 4.99K, C32 470Pf, R84 750Ω, C33 .01, C34 .01, C35 .01, C36 .01, R88 10K, R89 15K, R90 10K, R91 100Ω, R87 100Ω, R92 1K, R93 10Ω, C39 .1/20V, Q16 2N3640, CR25, CR26, Q17 2N3646, R97 1.5K, R98 10Ω, C40 .1/20V, R99 249Ω, Q15 2N3903, Q18 2N3905, R102 249Ω, C44 .1/20V, C43 .1/20V, C41 .1/20V, C42 .1/20V, +15V

C37 5Pf, C38 5Pf, R94 8.25K, UNITY GAIN, R95 10K, R96 523Ω, R100 10Ω, R106 10K, TP2, K4, (43,49) PRE-AMP OUT, TP3, R103 10K, R101 10Ω, (43,44,45,46)

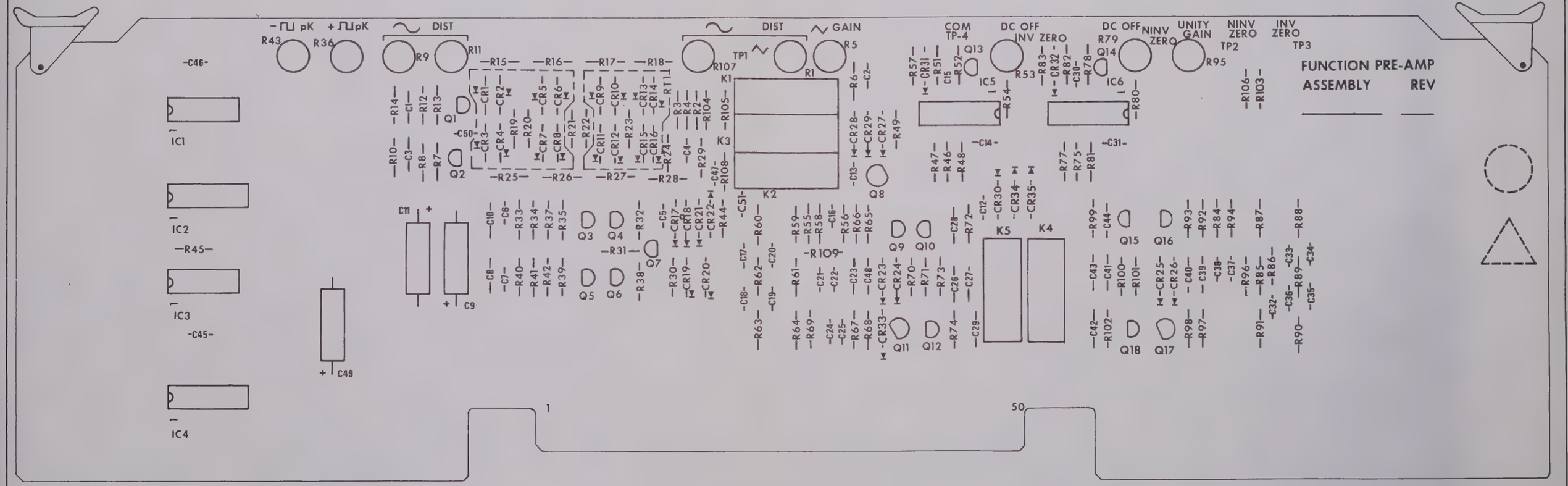
1) LAST REF. DESIGNATORS USED: K5, C51, TP4, IC6, CR35, R108, Q18, RT1

2) UNLESS OTHERWISE SPECIFIED; ALL CAPACITORS ARE MICROFARADS ALL DIODES ARE FD6666

NOTE UNLESS OTHERWISE SPECIFIED

(5) SQUARE WAVE ABERRATION TRIM CAP.

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-20-77	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR Tom Suiga	SEPT 7'77	TITLE: SCHEMATIC FUNCTION PRE-AMP.	
	RELEASE APPROV			
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030			
	DO NOT SCALE DWG		MODEL NO. 172A	DWG NO. 0103-00-0490 REV F
	SCALE		CODE IDENT 23338	SHEET 1 OF 1



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY FUNCTION/PREAMP ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO 172A / DWG NO 0101-00-0490 / REV
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,FUNCTION	0101-00-0490	WVTK	0101-00-0490	1
NONE	SCHEMATIC,FUNCTION	0103-00-0490	WVTK	0103-00-0490	1
C21 C37 C38	CAP,CER,5PF,1KV	DD-050	CRL	1500-00-5011	3
C22	CAP,CER,10PF,1KV	DD-100	CRL	1500-01-0011	1
C16	CAP,CER,100PF,1KV	DD-101	CRL	1500-01-0111	1
C25	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	1
C14 C17 C18 C19 C20 C31 C33 C34 C35 C36 C45 C46 C47 C5 C6 C7	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	16
C12 C13	CAP,CER,.1MF,10V	UK10-104	ARCO	1500-01-0412	2
C1 C10 C23 C26 C27 C28 C29 C3 C39 C40 C41 C42 C43 C44 C46 C8	CAP,CER,.1MF,20V	UK20-104	ARCO	1500-01-0413	16
C15 C30	CAP,CER,22PF,1KV	DD-220	CRL	1500-02-2011	2
C50	CAP,CER,33PF,1KV	DD-330	CRL	1500-03-3011	1
C4	CAP,CER,47PF,1KV	DD-470	CRL	1500-04-7011	1
C32	CAP,CER,470PF,1KV	DD-471	CRL	1500-04-7111	1
C24	CAP,CER,820PF,1KV	DD-821 LONG LEAD	CRL	1500-08-2101	1
C51	CAP,MICA,30PF,500V	DM15-300J	ARCO	1500-13-0000	1

WAVETEK PARTS LIST | TITLE PCA,FUNCTION BD | ASSEMBLY NO. 1100-00-0490 | PAGE: 1 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R15 R17 R25 R27	RES,MF,1/8W,1%,12.1K	RN55D-1212F	TRW	4701-03-1212	4
R22	RES,MF,1/8W,1%,13K	RN55D-1302F	TRW	4701-03-1302	1
R67 R97	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	2
R13 R31 R62 R7 R89	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	5
R16 R20 R26	RES,MF,1/8W,1%,16.5K	RN55D-1652F	TRW	4701-03-1652	3
R12 R47 R48 R77 R8 R81	RES,MF,1/8W,1%,2K	RN55D-2001F	TRW	4701-03-2001	6
R2 R3	RES,MF,1/8W,1%,21.5	RN55D-21R5F	TRW	4701-03-2159	2
R37 R42 R44	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	3
R86	RES,MF,1/8W,1%,237K	RN55D-2373F	TRW	4701-03-2373	1
R102 R51 R61 R72 R74 R82 R99	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	7
R34 R35 R38 R39 R41	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	5
R18 R28	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	4701-03-2492	2
R24	RES,MF,1/8W,1%,274	RN55D-2740F	TRW	4701-03-2740	1
R10 R14	RES,MF,1/8W,1%,301	RN55D-3010F	TRW	4701-03-3010	2
R109	RES,MF,1/8W,1%,316	RN55D-3160F	TRW	4701-03-3160	1
R4	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	1
R23 R70	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	2

WAVETEK PARTS LIST | TITLE PCA,FUNCTION BD | ASSEMBLY NO. 1100-00-0490 | PAGE: 3 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q16 Q9	TRANS	2N3640	FAIR	4901-03-6400	2
Q11 Q17 Q8	TRANS	2N3646	FAIR	4901-03-6460	3
Q10 Q15 Q2 Q5 Q6 Q7	TRANS	2N3903	FAIR	4901-03-9030	6
Q1 Q12 Q18 Q3 Q4	TRANS	2N3905	FAIR	4901-03-9050	5
RT1	THERMISTER	L812J2	FNWL	5300-00-0002	1
IC5 IC6	IC	CA-3096AE	RCA	7000-30-9600	2
IC1	IC	7416	SIG	8000-74-1600	1
IC3	IC	74LS74	TI	8000-74-7410	1
IC4	IC	74LS139B	SIG	8007-41-3910	1
IC2	IC	74LS175	TI	8007-41-7510	1

WAVETEK PARTS LIST | TITLE PCA,FUNCTION BD | ASSEMBLY NO. 1100-00-0490 | PAGE: 5 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C11 C49 C9	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-31-0101	3
NONE	FUNC PRE AMP	1700-00-0490	WVTK	1700-00-0490	1
TP1 TP2 TP3 TP4	TERM	45238-5.04	USECO	2100-05-0029	4
NONE	PC BD EJECTOR	103 BLUE	CALMK	2800-07-0014	2
K1 K2 K3 K5	RELAY,REED,FORM-C	RA3020-1051	ETROL	4500-00-0009	4
K4	RELAY,FORM C MERCURY	4500-00-0013	WVTK	4500-00-0013	1
R5	POT,TRIM,100	91AR100	BECK	4600-01-0103	1
R11 R9	POT,TRIM,1K	91AR1K	BECK	4600-01-0209	2
R95	POT,TRIM,10K	91AR10K	BECK	4600-01-0315	1
R1 R53 R79	POT,TRIM,20	91AR20	BECK	4600-02-0000	3
R36 R43	POT,TRIM,200	91AR200	BECK	4600-02-0101	2
R107	POT,TRIM,20K	91AR20K	BECK	4600-02-0301	1
R29 R32 R33 R40 R55 R59 R64 R87 R91	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	9
R19 R21 R49 R52 R57 R65 R78 R83 R92	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	9
R103 R104 R105 R106 R60 R63 R88 R90	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	8
R100 R101 R66 R68 R71 R73 R93 R98	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	8

WAVETEK PARTS LIST | TITLE PCA,FUNCTION BD | ASSEMBLY NO. 1100-00-0490 | PAGE: 2 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R108 R6 R85	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	3
R45 R54 R80	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	3
R69	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
R96	RES,MF,1/8W,1%,523	RN55D-5230F	TRW	4701-03-5230	1
R30	RES,MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	1
R58	RES,MF,1/8W,1%,68.1	RN55D-68R1F	TRW	4701-03-6819	1
R56 R84	RES,MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	2
R46 R75	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	2
R94	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TRW	4701-03-8251	1
CR31 CR32	DIODE	1N4581	MICRO	4801-01-4581	2
CR17 CR18 CR19 CR20	DIODE	FD-777	FAIR	4807-02-0777	4
CR21 CR22 CR23 CR24 CR25 CR26 CR27 CR28 CR29 CR30 CR34	DIODE	FD-6666	FAIR	4807-02-6666	11
CR33 CR35	DIODE	5082-2811	HP	4809-02-2811	2
CR1 CR10 CR11 CR12 CR13 CR14 CR15 CR16 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9	DIODE,SET,8-FD-777 QTY:8:4807-02-0777	182-500-98	WVTK	4898-00-0010	2
Q13 Q14	TRANS	2N3565	FAIR	4901-03-5650	2

WAVETEK PARTS LIST | TITLE PCA,FUNCTION BD | ASSEMBLY NO. 1100-00-0490 | PAGE: 4 | REV E

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST FUNCTION/PREAMP
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 1100-00-0490 / REV E
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP
A	ENG IMPRV.	TLF	6-22-77	

CONTROL LOGIC

TRIGGER CIRCUIT

TRIGGER, TRI. GEN ASSY.-0559

NOTE UNLESS OTHERWISE SPECIFIED LAST REF. DESIGNATORS USED P181-C105-CR39-IC20 L2-K4-Q53

2) ALL CAPACITORS ARE IN MICROFARADS. ALL DIODES ARE FD6666.

3. UNUSED PINS: IC13-1,5,9,2,6,&8 IC12-3&4 IC11-1,2,3,4,5,&6

4. R2 AND R7 SIPS ARE 10K

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6/30/77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROLENGR CP Tom Dalga	1977 28 OCT	TITLE SCHEMATIC TRIANGLE GENERATOR COPY 1: SPURIOUS FIX
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A
	SCALE		DWG NO. 0103-00-0635 REV A
			CODE IDENT 23338 SHEET 1 OF 2

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GEN, HYS SW ASSY. 0558

REV	ECN	BY	DATE	APP

CAPACITANCE MULTIPLIER ASSY. 0635

TRIANGLE BUFFER ASSY. 0560

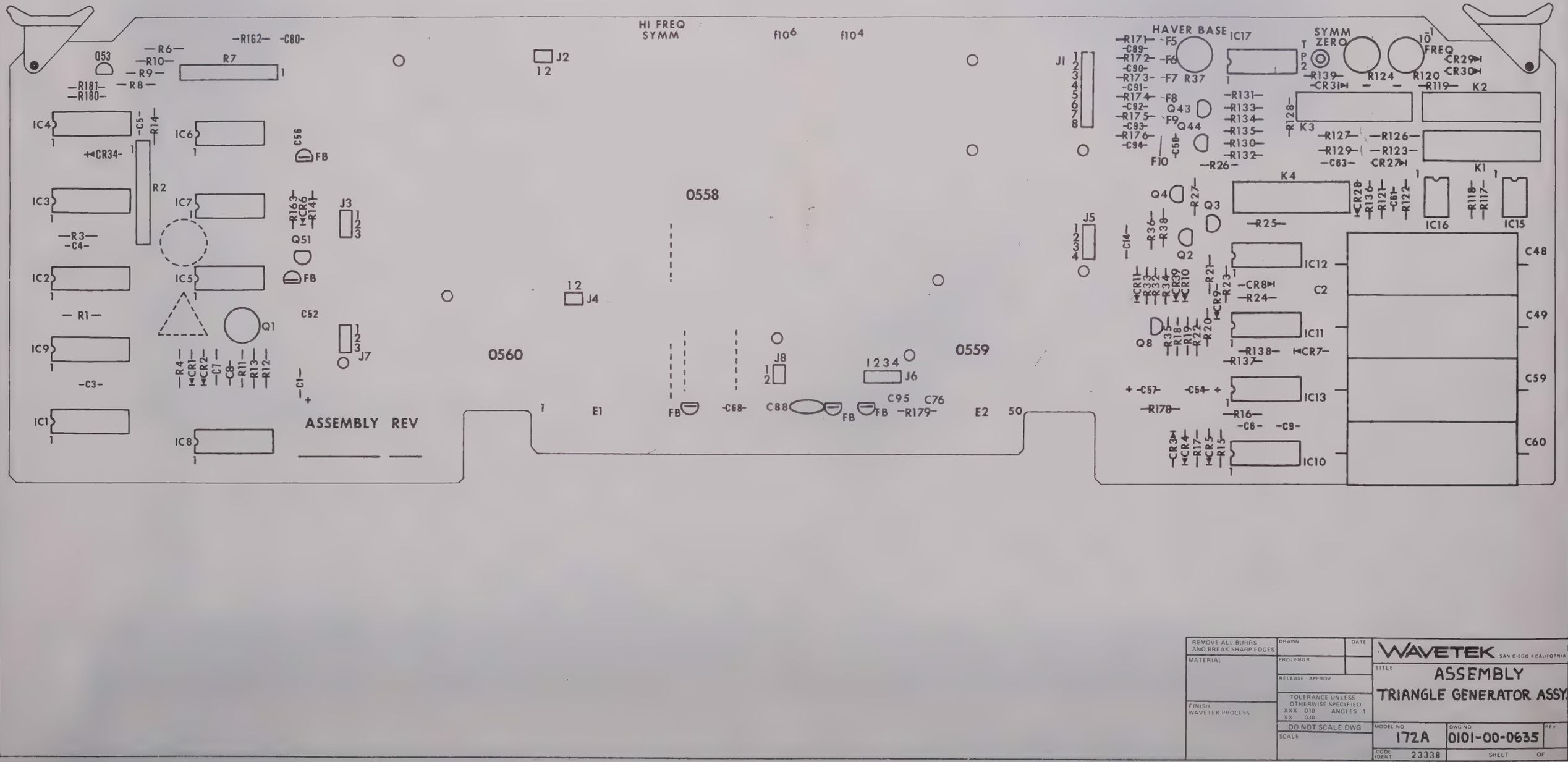
NOTE: △ = 130-501-6 MATCHED SETS (C45, C46, C47, C48, C49)

* SELECTED FOR <4V. VGS(OFF) C58, C62 ELIM.

NOTE: UNLESS OTHERWISE SPECIFIED

1. R2 AND R7 SIPS ARE 10K

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 7-1-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR'G Tom Seliga	SEPT 8'77	TITLE SCHEMATIC TRIANGLE GENERATOR COPY 1: SPURIOUS FIX
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 172A
	DO NOT SCALE DWG		DWG NO 0003-00-0635 REV A
	SCALE		CODE IDENT 23338 SHEET 2 OF 2



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO + CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY TRIANGLE GENERATOR ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0635 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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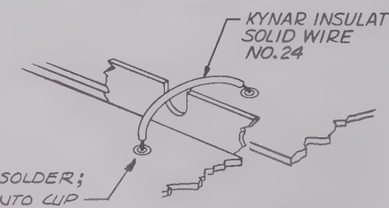
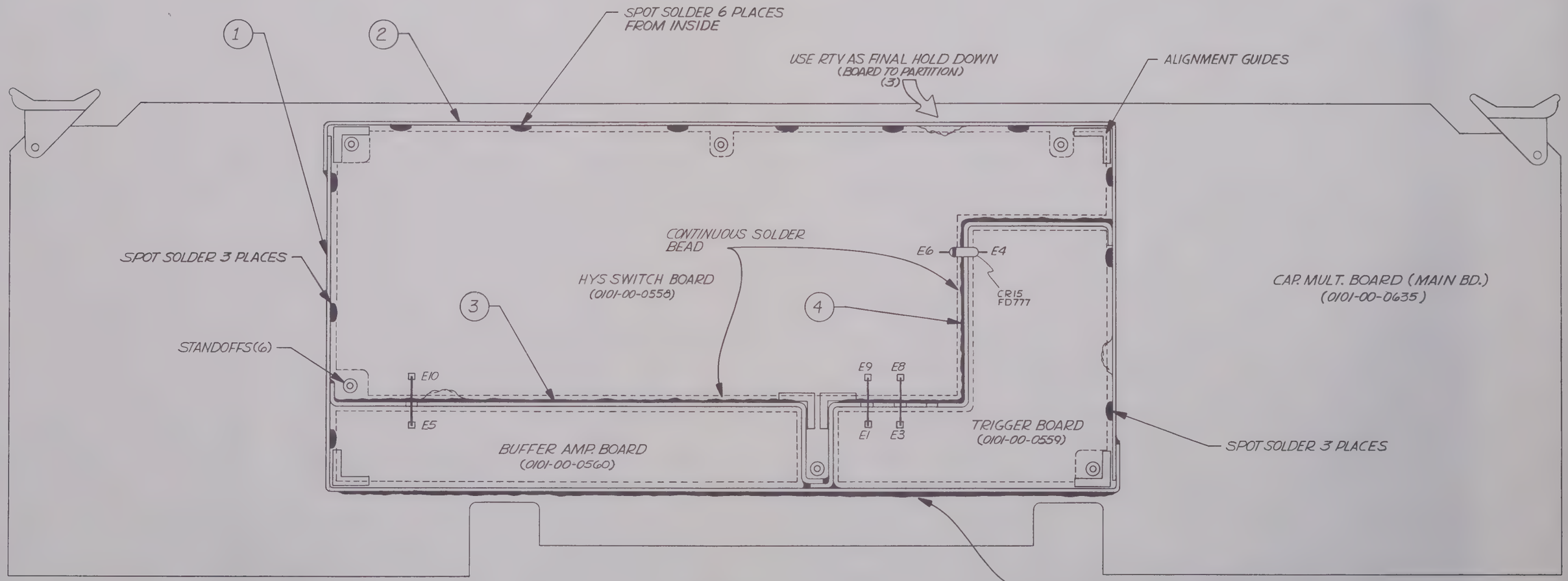
REV	ECN	BY	DATE	APP

DETAIL "B"





(1) = REF. PARTITION NO. 1400-00-6661
(2) = " " " 1400-00-6651
(3) = " " " 1400-00-6671
(4) = REF. PARTITION NO. 1400-00-6681

ASSEMBLY STEPS

1. SWEDGE AMP PINS AND 6 STANDOFFS IN, PUT 6 NYLON SCREWS IN STANDOFFS FOR FUTURE USE
2. LOAD COMPONENTS ON MAIN BD (-0635) AND FLOW SOLDER
   CAUTION: IT IS IMPORTANT TO KEEP SQUARE SUB-BOARD PINS VERTICAL WHEN SOLDERING.
3. LAY PREFORMED METAL PARTITIONS ON BOARD BEING CAREFUL TO POSITION ON ETCHED ALIGNMENT GUIDES; SOLDER AS INDICATED
4. BOARD IS NOW READY FOR INSTALLATION OF ITS 3 SUB-ASSY BOARDS
5. INTER CONNECT SUB-ASSY BOARDS BETWEEN "E" RECEPTACLE CUPS AS SHOWN ABOVE AND SHOWN IN DETAIL "B"

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6/77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Salga	Spec 177	TITLE ASSEMBLY METAL WORK, TRI. GEN
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0101-00-0635 REV A
	SCALE	CODE IDENT 23338	SHEET 2 OF 3

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG,TRI GEN	0101-00-0635	WVTK	0101-00-0635	1
NONE	SCHEMATIC TRI.GEN.	0103-00-0635	WVTK	0103-00-0635	1
NONE	HYS.SWITCH TRI GEN	172-558	WVTK	1208-00-0558	1
NONE	TRIGGER TRI GEN	172-559	WVTK	1208-00-0559	1
NONE	BUFFER AMP TRI GEN	172-560	WVTK	1208-00-0560	1
NONE	SHIELD	1400-00-6651	WVTK	1400-00-6651	1
NONE	SHIELD	1400-00-6661	WVTK	1400-00-6661	1
NONE	SHIELD	1400-00-6671	WVTK	1400-00-6671	1
NONE	SHIELD	1400-00-6681	WVTK	1400-00-6681	1
NONE	SHIELD REF:3200-03-0001	1400-00-6881	WVTK	1400-00-6881	1
C61 C9	CAP,CER,100PF,1KV	DD-101	CRL	1500-01-0111	2
C2 C3 C4 C5 C50 C52 C6 C76 C80 C89 C90 C91 C92 C93 C94	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	15
C68 C8	CAP,CER,.1MF,10V	UK10-104	AMCO	1500-01-0412	2
C14 C63 C7	CAP,CER,.1MF,20V	UK20-104	AMCO	1500-01-0413	3
C59 C60	CAP,POLYC,5MF,100V	C1A505F	ELPAC	1500-45-0504	2
C1 C54 C57	CAP,TANT,27MF,35V	196D276X0035FB	SPRAG	1500-72-7602	3

WAVETEK PARTS LIST | TITLE PCA,TRIANGLE GEN CAP.MULT | ASSEMBLY NO. 1100-00-0635 | PAGE: 1 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R179 R21	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	2
R118 R23 R32 R4	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	4
R122 R139 R15 R16 R171 R172 R173 R174 R175 R176 R19 R27	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	12
R121	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	1
R138	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	1
R163	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	1
R26	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	1
R22	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW	4701-03-1781	1
R129	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	1
R13 R130	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	2
R10 R11 R117 R35 R6 R8 R9	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	7
R134	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	4701-03-2492	1
R132	RES,MF,1/8W,1%,332	RN55D-3320F	TRW	4701-03-3320	1
R136	RES,MF,1/8W,1%,3.32K	RN55D-3321F	TRW	4701-03-3321	1
R141	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	1
R133 R135	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	2

WAVETEK PARTS LIST | TITLE PCA,TRIANGLE GEN CAP.MULT | ASSEMBLY NO. 1100-00-0635 | PAGE: 3 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q53	TRANS	2N3640	FAIR	4901-03-6400	1
Q2	TRANS	2N3646	FAIR	4901-03-6460	1
Q44	TRANS	2N3903	FAIR	4901-03-9030	1
Q3 Q4 Q43 Q51 Q8	TRANS	2N5139	FAIR	4901-05-1390	5
IC5 IC6 IC7	IC	MLM339P	MOT	7000-03-3900	3
IC15 IC16	IC,OP-AMP	LF356N	NAT	7000-03-5600	2
IC12 IC13 IC17	IC	7416	SIG	8000-74-1600	3
IC11	IC	7474	TI	8000-74-7400	1
IC10	IC	74LS132	TI	8007-41-3210	1
IC1 IC8	IC	74LS139B	SIG	8007-41-3910	2
IC3 IC4	IC	74LS145B	SIG	8007-41-4510	2
IC2 IC9	IC	74LS175	TI	8007-41-7510	2

WAVETEK PARTS LIST | TITLE PCA,TRIANGLE GEN CAP.MULT | ASSEMBLY NO. 1100-00-0635 | PAGE: 5 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C56 C88 C95	CAP,CER,.1MF,50V	DG45BX104MP	RSTCP	1509-90-0011	3
NONE	SHIELD,COVER TRI.GEN	1700-00-0625	WVTK	1700-00-0625	1
NONE	TRIANGLE GENERATOR	1700-00-0635	WVTK	1700-00-0635	1
NONE	CONN	60598-8	AMP	2100-05-0017	10
TP2	TERM	4523B-5.04	USECO	2100-05-0029	1
NONE	CONN PIN,MALE (UOM=EA PIN)	CA-836SP-100-230-830	CA	2100-05-0034	28
NONE	STANDOFF	SS168-10-5A	UNICP	2800-06-0003	6
NONE	PC BD EJECTOR	103 GREEN	CALMK	2800-07-0013	2
NONE	TRANSIPAD	10123N	METHS	2800-11-0003	1
NONE	SCREW,2-56X1/4 NYLON	2-56X1/4 NYLON SCREW	WEKSR	2800-23-0009	6
NONE	BALUN CORE	2873000902	FAIRT	3100-00-0002	5
K1 K2 K3	RELAY,REED,FORM-A	RA3019-1051	ETROL	4500-00-0007	3
K4	RELAY,REED,FORM-C	RA3020-1051	ETROL	4500-00-0009	1
R120 R37	POT,TRIM,1K	91AM1K	BECK	4600-01-0209	2
R124	POT,TRIM,20K	91AR20K	BECK	4600-02-0301	1
R128	RES,MF,1/8W,.1%,10K	RN55E-1002B	TRW	4701-02-1002	1
R127	RES,MF,1/8W,.1%,100K	RN55E-1003B	TRW	4701-02-1003	1

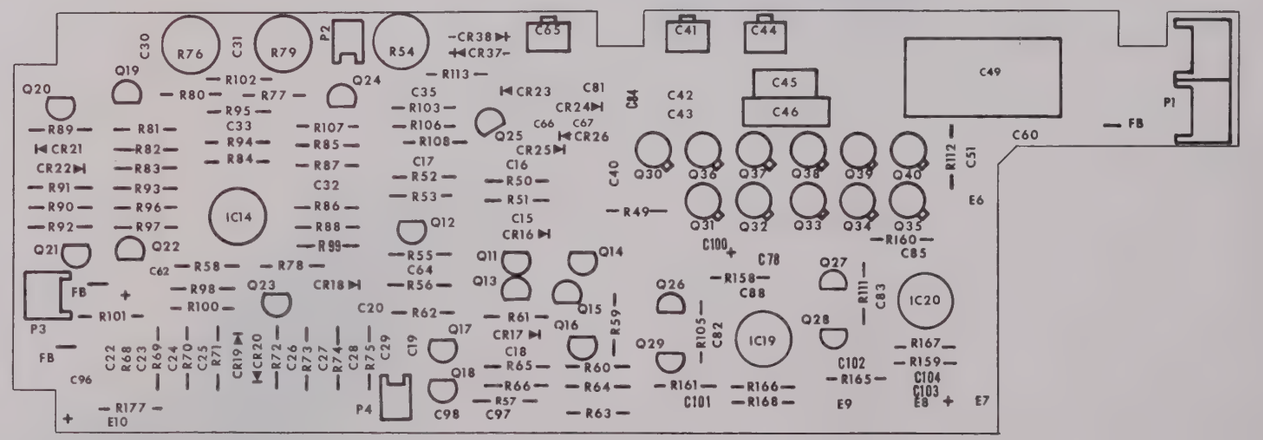
WAVETEK PARTS LIST | TITLE PCA,TRIANGLE GEN CAP.MULT | ASSEMBLY NO. 1100-00-0635 | PAGE: 2 | REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R162	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	1
R178	RES,MF,1/8W,1%,42.2	RN55D-42R2F	TRW	4701-03-4229	1
R137 R17	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	2
R1 R12 R14 R180 R181 R20 R24 R25 R3 R33 R36 R38	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	12
R18	RES,MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	1
R119	RES,MF,1/8W,1%,6.98K	RN55D-6981F	TRW	4701-03-6981	1
R131	RES,MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	1
R34	RES,MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	1
R126	RES,MF,1/4W,1%,1M	RN60D-1004F	TRW	4701-13-1004	1
R2 R7	RES MODULE	4310R-101-103	BOURN	4770-00-0008	2
R123	RES,MF,.6W,1%,10M	ML-181	CADDO	4799-00-0003	1
CR27	DIODE	1N4581	MICRO	4801-01-4581	1
CR4	DIODE	1N4732	MOT	4801-01-4732	1
CR10 CR11	DIODE	FD-777	FAIR	4807-02-0777	2
CR1 CR2 CR28 CR29 CR3 CR30 CR31 CR34 CR39 CR5 CR6 CR7 CR8 CR9	DIODE	FD-6666	FAIR	4807-02-6666	14
Q1	TRANS	2N2905A	FAIR	4901-02-9051	1

WAVETEK PARTS LIST | TITLE PCA,TRIANGLE GEN CAP.MULT | ASSEMBLY NO. 1100-00-0635 | PAGE: 4 | REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR		TITLE: PARTS LIST TRIANGLE GENERATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A | DWG NO 1100-00-0635 | REV A
	SCALE		CODE IDENT 23338 | SHEET OF



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: ASSEMBLY HYSTERESIS SWITCH, TRIANGLE GENERATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0558 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG,HYS SWITCH	0101-00-0558	WVTK	0101-00-0558	1
NONE	SCHEMATIC TRI.GEN.	0103-00-0635	WVTK	0103-00-0635	1
C23 C28 C64 C97 C98	CAP,CER,5PF,1KV	DD-050	CRL	1500-00-5011	5
C30 C31	CAP,CER,100PF,1KV	DD-101	CRL	1500-01-0111	2
C33 C60 C85 C88	CAP,CER,.001MF,1KV	DD-102 LONG LEAD	CRL	1500-01-0201	4
C101 C102 C104 C16 C17 C18 C19 C32 C35 C51 C78	CAP,CER,.01MF,50V	CK-103 LONG LEAD	CRL	1500-01-0300	11
C25 C26	CAP,CER,22PF,1KV	DD-220	CRL	1500-02-2011	2
C81	CAP,MICA,150PF,500V	DM15-151J	ARCO	1500-11-5100	1
C15 C40	CAP,MICA,20PF,500V	DM15-200J	ARCO	1500-12-0000	2
C24 C27	CAP,MICA,30PF,500V	DM15-300J	ARCO	1500-13-0000	2
C43	CAP,MICA,43PF,500V	DM15-430J	ARCO	1500-14-3000	1
C84	CAP,MICA,68PF,500V	DM15-680J	ARCO	1500-16-8000	1
C42	CAP,MICA,820PF,500V	DM15-821F	ARCO	1500-18-2101	1
C41 C44	CAP,VARI,7-35PF,250V	300-402-603	TRIKO	1500-53-5010	2
C100 C103 C62 C96	CAP,TANT,22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	4

WAVETEK PARTS LIST | TITLE HYS.SWITCH TRI GEN | ASSEMBLY NO. 1208-00-0558 | PAGE: 1 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R76 R79	POT,TRIM,500	91AR500	BECK	4600-05-0104	2
R100 R101 R103 R107 R61 R98	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	6
R82 R96	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	2
R112 R113 R159 R168	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	4
R59 R85 R88	RES,MF,1/8W,1%,1.21K	RN55D-1211F	TRW	4701-03-1211	3
R64	RES,MF,1/8W,1%,124	RN55D-1240F	TRW	4701-03-1240	1
R69 R92	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	2
R105 R111 R51	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	3
R49 R81 R97	RES,MF,1/8W,1%,15	RN55D-15R0F	TRW	4701-03-1509	3
R108	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW	4701-03-1781	1
R63 R69 R74	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	5
R177 R68 R75	RES,MF,1/8W,1%,21.5	RN55D-21R5F	TRW	4701-03-2159	3
R166 R167	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	2
R102 R158 R160	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	3
R57	RES,MF,1/8W,1%,274	RN55D-2740F	TRW	4701-03-2740	1
R94	RES,MF,1/8W,1%,316	RN55D-3160F	TRW	4701-03-3160	1
R99	RES,MF,1/8W,1%,3.32K	RN55D-3321F	TRW	4701-03-3321	1

WAVETEK PARTS LIST | TITLE HYS.SWITCH TRI GEN | ASSEMBLY NO. 1208-00-0558 | PAGE: 3 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q14 Q16 Q17 Q18 Q19 Q22 Q29	TRANS	2N5640	FAIR	4901-03-6400	7
Q25 Q28	TRANS	2N3646	FAIR	4901-03-6460	2
Q24	TRANS	2N5139	FAIR	4901-05-1390	1
Q26	TRANS	2N5460	MOT	4901-05-4600	1
Q27	TRANS	2N5485	NSC	4901-05-4850	1
Q30 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40	TRANS	SD2150E	SIG	4902-00-2140	11
Q11 Q13	TRANS,M/PR/2N5486 Q1Y12=4901-05-4860	4998-00-0041	WVTK	4998-00-0041	1
IC19 IC20	IC,OP-AMP	LF356N	NAT	7000-03-5600	2
IC14	IC	CA-3049	RCA	7000-30-4900	1

WAVETEK PARTS LIST | TITLE HYS.SWITCH TRI GEN | ASSEMBLY NO. 1208-00-0558 | PAGE: 5 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
	CAP,SET,POLYC CONSIST:1509-90-0001 THRU:0004	130-501-6	WVTK	1509-80-0005	1
C45	CAP,POLYC,.01MF,100V PART OF 1509-80-0005 QTY:01:1500-41-0304				
C46	CAP,POLYC,.1MF,100V PART OF 1509-80-0005 QTY:01:1500-41-0404				
C47	CAP,POLYC,1MF,100V PART OF 1509-80-0005 QTY:01:1500-41-0504				
C48 C49	CAP,POLYC,5MF,100V PART OF 1509-80-0005 QTY:02:1500-45-0504				
C20	CAP,CER,.1MF,50V	DG45BX104MP	MSTCP	1509-90-0011	1
NONE	HYS SWITCH	1700-00-0558	WVTK	1700-00-0558	1
P2 P4	CONN	22-17-2022	MOLEX	2100-02-0061	2
P1A P1B	CONN	22-17-2042	MOLEX	2100-02-0065	2
P3	CONN	22-17-2032	MOLEX	2100-02-0066	1
NONE	SOCKET	5-330808-0	AMP	2100-03-0044	4
NONE	BALUN CORE	2873000902	FAIRIT	3100-00-0002	3
R54	POT,TRIM,200	91AR200	BECK	4600-02-0101	1

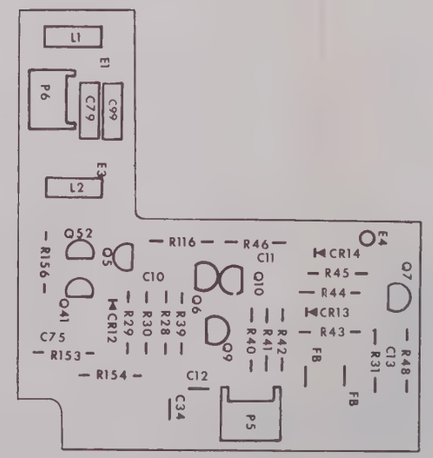
WAVETEK PARTS LIST | TITLE HYS.SWITCH TRI GEN | ASSEMBLY NO. 1208-00-0558 | PAGE: 2 | REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R106 R80 R83 R91 R93	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	5
R62	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	1
R66	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	1
R77 R78	RES,MF,1/8W,1%,4.32K	RN55D-4321F	TRW	4701-03-4321	2
R58 R84	RES,MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	2
R53 R60 R65	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	3
R161 R165 R50 R52 R70 R73	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	6
R71 R72 R86	RES,MF,1/8W,1%,619	RN55D-6190F	TRW	4701-03-6190	3
R55 R56 R95	RES,MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	3
R87	RES,MF,1/8W,1%,6.81K	RN55D-6811F	TRW	4701-03-6811	1
R90	RES,MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	1
CR17	DIODE	1N751A	SIEM	4801-01-0751	1
CR18	DIODE	1N4581	MICRO	4801-01-4581	1
CR15 CR19 CR20 CR21 CR22 CR23 CR24 CR25 CR26 CR37 CR38	DIODE	FD-777	FAIR	4807-02-0777	11
CR16	DIODE	FD-6666	FAIR	4807-02-6666	1
Q12 Q15 Q20 Q21 Q23	TRANS	2N3563	FAIR	4901-03-5630	5

WAVETEK PARTS LIST | TITLE HYS.SWITCH TRI GEN | ASSEMBLY NO. 1208-00-0558 | PAGE: 4 | REV E

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST HYSTERESIS SWITCH TRIANGLE GENERATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 1208-00-0558 / REV E
	SCALE		CODE IDENT 23338 / SHEET OF



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: ASSEMBLY TRIGGER, TRIANGLE GEN. ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0559 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,TRIGGER	0101-00-0559	WVTK	0101-00-0559	1
NONE	SCHEMATIC TRI.GEN.	0103-00-0635	WVTK	0103-00-0635	1
C13 C75	CAP,CER,.01MF,50V	CK-103 LONG LEAD	CRL	1500-01-0300	2
C10	CAP,CER,22PF,1KV	DD-220	CRL	1500-02-2011	1
C11	CAP,CER,330PF,1KV	DD-331	CRL	1500-03-3111	1
C79 C99	POLYC,.0022MF,200V	192P22292	SPRAG	1500-42-2204	2
C12 C34	CAP,CER,.1MF,50V	DG45BA104MP	WSTCP	1509-96-0011	2
NONE	TRIGGER	1700-00-0559	WVTK	1700-00-0559	1
L1 L2	CHOKE,1e0MH	1537-84	DLVAN	1800-00-0016	2
P5 P6	CONN	22-17-2042	MOLEX	2100-02-0065	2
NONE	SOCKET	5-330808-0	AMP	2100-03-0044	5
NONE	BALUN CORE	2873000902	FARIT	3100-00-0002	2
R156 R28 R31 R44	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	4
R29 R30	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	2
R154	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	1
R42	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	1
R46	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	1
R116	RES,MF,1/8W,1%,301	RN55D-3010F	TRW	4701-03-3010	1

WAVETEK PARTS LIST	TITLE TRIGGER TRI GEN	ASSEMBLY NO. 1208-00-0559 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R45	RES,MF,1/8W,1%,301K	RN55C-3013F	TRW	4701-03-3013	1
R39	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	1
R153	RES,MF,1/8W,1%,4.99K	RN55C-4991F	TRW	4701-03-4991	1
R40 R41	RES,MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	2
R43 R48	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	2
CR13	DIODE	1N751A	SIEM	4801-01-0751	1
CR14	DIODE	FD-777	FAIR	4807-02-0777	1
CR12	DIODE	FD-6666	FAIR	4807-02-0666	1
Q41 Q52	TRANS	2N3565	FAIR	4901-03-5650	2
Q5	TRANS	2N3640	FAIR	4901-03-6400	1
Q6 Q7	TRANS	2N3646	FAIR	4901-03-6460	2
Q10 Q9	TRANS,M/PR/2N5486 QTY:2:4901-05-4860	4998-00-0041	WVTK	4998-00-0041	1

WAVETEK PARTS LIST	TITLE TRIGGER TRI GEN	ASSEMBLY NO. 1208-00-0559 PAGE: 2	REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST TRIGGER TRIANGLE GENERATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX .030		MODEL NO. 172A / DWG NO 1208-00-0559 / REV B
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROTENGR		TITLE ASSEMBLY BUFFER AMPLIFIER TRIANGLE GENERATOR ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0560 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,BUFFER AMP	0101-00-0560	WVTK	0101-00-0560	1
NONE	SCHEMATIC TRI.GEN.	0103-00-0635	WVTK	0103-00-0635	1
C71	CAP,CER,100PF,1KV	DC-101	CRL	1500-01-0111	1
C68 C70 C72 C73	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	4
C69 C74	CAP,CER,.1MF,50V	DG45BX104MP	MSTCP	1509-90-0011	2
NONE	BUFFER AMP	1700-00-0560	WVTK	1700-00-0560	1
P8	CONN	22-17-2022	MOLEX	2100-02-0061	1
P7	CONN	22-17-2032	MOLEX	2100-02-0066	1
NONE	SOCKET	5-330808-0	AMP	2100-03-0044	1
NONE	BALUN CORE	28730U0902	FAIRIT	3100-00-0002	3
R140 R148 R169	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	3
R143 R152 R170	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	3
R144 R145	RES,MF,1/8W,1%,124	RN55D-1240F	TRW	4701-03-1240	2
R151	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	1
R147	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	1
R149	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	1
R141 R142 R146	RES,MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	3
R150	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	1

WAVETEK PARTS LIST	TITLE BUFFER AMP TRI GEN	ASSEMBLY NO. 1206-00-0560 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	DWG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
CR33	DIODE	1N4581	MICRO	4801-01-4581	1
CR32	DIODE	FD-6666	FAIR	4807-02-6666	1
Q45 Q48	TRANS	2N3563	FAIR	4901-03-5630	2
Q46 Q49	TRANS	2N3903	FAIR	4901-03-9030	2
Q47 Q50	TRANS	2N5139	FAIR	4901-05-1390	2

WAVETEK PARTS LIST	TITLE BUFFER AMP TRI GEN	ASSEMBLY NO. 1206-00-0560 PAGE: 2	REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST BUFFER AMPLIFIER, TRIANGLE GENERATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO. 1208-00-0560 / REV A
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP
B		TLF	9/22/77	

FREQUENCY

RANGE

SYMMETRY

MODE 1

IC1 74LS139 — SYMST0 (B7)

IC2 74LS175 — FMSD8-1 (C6,3B6); FMSD4-1 (C6,3B6); FMSD2-1 (C6,3B6); FMSD1-1 (C6)

IC3 74LS175 — FMD8-1 (C6); FMD4-1 (C6); FMD2-1 (C6); FMD1-1 (C6)

IC4 74LS175 — FLSD8-1 (C6); FLSD4-1 (C6); FLSD2-1 (C6); FLSD1-1 (C6)

IC5 74LS175 — S (D8); S/ (3A8)

IC6 LM301

IC7 74LS139

IC8 74LS175

IC9 AD563J — FREQ. D/A; MSB; LSB; DACFBK (2D6); DACOUT (2D8)

IC10 74LS145

IC11 74LS145

IC12 74LS145

IC13 74LS175

IC14 7416

Q1 2N5462

Q2 2N3646

CR1 FD6666

CR2 FD6666

CR3 HP2811

CR4

R1 15K; R2 7.5K; R3 249Ω; R4 4.99K; R5 15K; R6 4.99K; R7 200Ω; R8 10Ω; R9 10K; R9-2 10K; R10 4.99K; R11 4.99K; R12 4.99K; R13 10K; R14-7 10K; R15 10K

C1 100μf 16V; C2 .1/10V; C4 33pf; C5 .1/20V; C6 .1/20V; C7 .1/20V; C8 .1/20V

6 TYP .1/10V (C52-C57)

VCG IN A,B (25); VCG IN; VCG OFF (B1); MOTHER BD.; A,B +5V (19,20); A,B (22,23,24)

+5V; +15V; -15V

S(D2); (C7); (C7)

FMSD8-1 (D6); FMSD4-1 (D6); FMSD2-1 (D6); FMSD1-1 (D6); FMD8-1 (D4); FMD4-1 (D4); FMD2-1 (D4); FMD1-1 (D4); FLSD8-1 (D3); FLSD4-1 (D3); FLSD2-1 (D3); FLSD1-1 (D3)

SYMST0 (D7); A0 (D7); A1 (D7)

60-80-1 (2B6); 10-40-1 (2C5)

50-0 (2B7); 10-60-0 (2B7); 20-70-0 (2B7); 30-80-0 (2B7); 40-90-0 (2B7)

FB1-1; FB2-1; FB4-1 (3C3)(3C4)

F11-0 (2D7); F12-0 (2D7); F13-0 (2D6); F14-0 (2D6); F15-0 (2D6)(2B3); F16-0 (2B7) (2B3)

M3-1 (3A8); M2-0 (3A8); M1-0; M1-1

VCG OFF-1 (C7)

D3(11)A; D4(10)A; D5(9)A; D6(8)A; D7(7)A

A0(2)A; A2(3)A; STRB0(1)A; A1(4)A; A0(5)A; D0(14)A; D1(13)A; D2(12)A; S(6)A

LAST REF. DES. USED: T1, R133, C60, Q41, CR17, IC41, TP5, FB3

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6/1/76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR R.D. Tom Serra	SEPT 8177	TITLE: SCHEMATIC VCG AND SYMMETRY
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		
	SCALE	MODEL NO. 172A	DWG NO. 0103-00-0612 REV B
		CODE IDENT 23338	SHEET 1 OF 3

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REV	ECN	BY	DATE	APP

(1C5) DACFBK — R21 500Ω 10² TOP — R26 10K — R27 10K

10⁰ 10¹ 10³ 10⁵

R17 100K (Q3) X1 F11-0 (1C1)
R18 100K (Q4) X10 F12-0 (1C1)
R19 49.9K (Q5) X100 X10K X10M F13-0 (1C1)
R20 100K (Q6) X1K F14-0 (1C1)
R22 100K (Q7) X100K F15-0 (B3)(1C1)

(5) 2N5462

DAC OUT (1C5) — VCG SUM (3C1) — E1 — E2 — R16 499

CR5 FD6666 — C11 22pf

R23 2.49K — R24 301K — R28 100K 10² BOTT FREQ. — R25 49.9K — C10 .1/10V — C12 .1/10V — R29 49.9K

+15V — IC16 LF356 — -15V

0.7 0.5V TYP

R30 10K — GCV OUT → (21B) GCV OUT

R31 2.49K

R40 69.8K NOM — R41 1.5K 0.1%

R34 1.5K 0.1% — R35 1.5K 0.1% — R36 1.5K 0.1% — R37 750 0.1% — R38 750 0.1% — R39 7.5K 0.1%

Q8 2N5462 — Q9 2N5462 — Q10 2N5462 — Q11 2N5462 — Q12 2N5462 — Q13 SD215 — R42 15K — Q14 2N5462

10-50-1 (1B4)

C9 33pf — IC15 LF356 — R32 249K — R33 20K — -15 — +15 — LO SYMM

(1B4) 50-0
(1B4) 40,90-0
(1B4) 30,80-0
F16-0 (1C1)(B3)
20, 70-0 (1B4)
10, 60-0 (1B4)

-15V — R51 15K — C13, .1/10V — R52 15K

R53 2.49K — C14 47pf — C15 +15V 0.1/20V — IC17 LF356 — R54 2.49K — Q22 2N5485 — C16 0.1/20V — -15V

(1B4) 50-90-1 — Q16 SD215 — Q15 2N5462 — Q17 2N5462 — Q18 2N5462 — Q19 2N5462 — Q20 2N5462 — Q21 2N5462

R43 1.5K 0.1% — R44 7.5K 0.1% — R45 750 0.1% — R46 750 0.1% — R47 1.5K 0.1% — R48 1.5K 0.1% — R49 1.5K 0.1% — R50 2.49K — R56 69.8K NOM

C17 33pf — IC18 LF356 — R55 2.49K — Q23 2N5462 — C21 .1/20V — -15V

R57 2K — C18 .1/20V — +15V — C19 +24V .01 — C20 33pf — IC19 LF356 — -15V

+24V — R64 499 — Q24 2N5139 — R65 3.65K — R72 100 X10 TOP SYM — NOM R71 15K — R73 825 — X10 TOP SYM — R66 1.78K — R67 200

Q25 2N5462 — Q26 2N5462 — Q27 2N5462 — CR8 — R61 10K — R62 24.9K — R60 7.5K — R58 20K — 1000:1 SYM — (3C) POS CVR

Q28 2N3903 — +15V — R63 15K — R70 10K — R68 1.5K — R69 10K — Q29 2N4248 — CR6 — CR7 — F15-0 (1C1) — F16-0 (1C1)

(40) NEG CUR

IC20 LF356 — -24V — R77 24.9K — R75 20K — 1000:1 SYM — C22 33pf — R78 10K — Q30 2N5485 — Q31 2N3903 — R80 3.65K — R81 499 — -24V — -15V — R74 2K

CR9 — Q32 2N5485 — Q33 2N5485 — R79 1.78K — R82 61.9 — R85 1K — R83 825 — R84 825 — C23 .1/20V

IC21 LF356 — C24 .01 50V — -24V — C25 33pf — R86 2.49K — Q34 2N5435 — Q35 2N5185 — (38) CI

+15V (33,34) → +15V
(26,27,28) → TP1
-15V (30,31) → -15V
+24V (43) → +24V
-24V (41) → -24V

C3 .1/10V — C52 .1/10V — C53 .1/10V — C54 .1/10V — +5

LAST REF. DES. USED:
TI, R133, C60, Q41, CR17, IC41, TP5, FB3

NOTE: UNLESS OTHERWISE SPECIFIED

⚠ SELECTED 2N5462 FETS; V_g < 5V; SPEC #4998-00-0040

2. R34, R35, R36, R37, R38, R39, R41, R43, R44, R45, R47, R48, R46, AND R49 PRECISION .1% RESISTORS

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 6-14-78	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR Tom Saliga	SEPT 8'77	TITLE: SCHEMATIC - VCG & SYMMETRY
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		
	SCALE		MODEL NO. 172A — DWG NO. 0103-00-0612 — REV B
			CODE IDENT 23338 — SHEET 2 OF 3

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND DESIGN RIGHTS BELONGING TO WAVETEK AND MAY NOT BE REPRODUCED FOR ANY REASON EXCEPT CALIBRATION, OPERATION, AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION.

REV	ECN	BY	DATE	APP

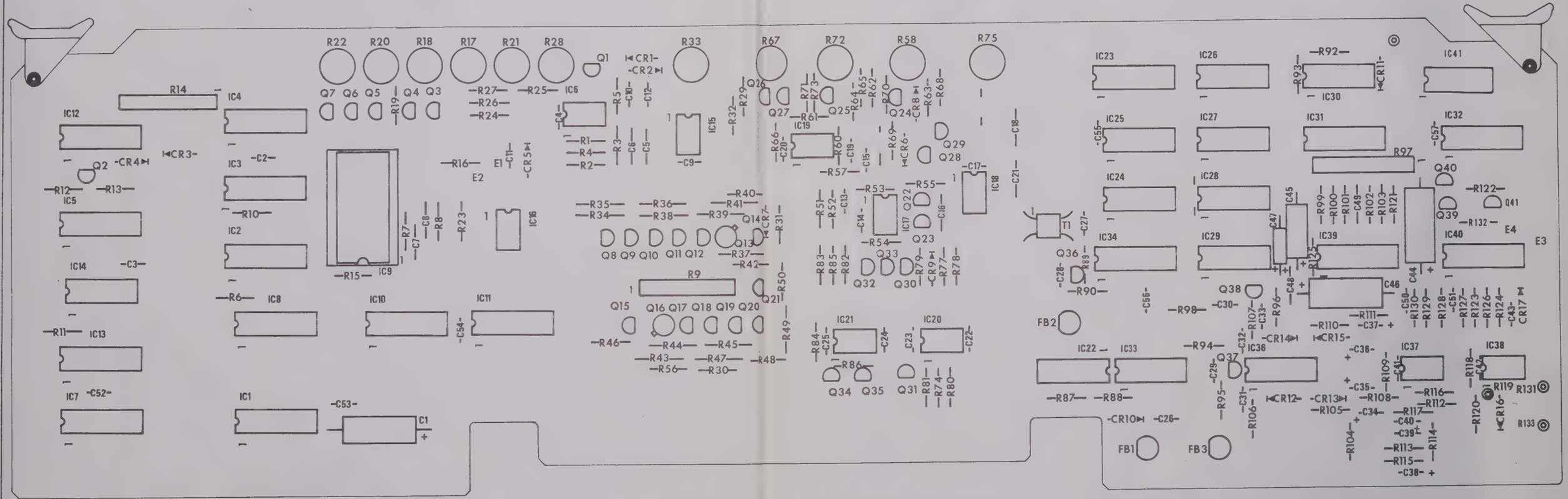
GENOUT(44)
PHLKIN(50)
SYNOC(46)
SYNOD(48)
EXTON-Ø (A7)
SYNON-Ø (A7)
PHLKON-Ø
SYNON-Ø (B6)
EXTRON-Ø (D7)
(1D2) FR1-1 FR2-1 FR4-1 (C6, B6)
(1B4) RNG1-Ø RNG2-Ø RNG34-Ø RNG5-Ø RNG6-Ø
(1D2) FR1-1 FR2-1 FR4-1
(1D0) FMSD2-1 FMSD4-1 FMSD8-1
(1B3) M3-1 MØ-Ø MØ-1
(1D2) S-1
GI-Ø (B4)
G2-Ø (B4)
G4-Ø (B4)
GR6-Ø (A5)
FEQ12-Ø (A4)
FEQ12-Ø (C1)
GR6-0(C1)
VCG SUM (2D8)
LOOP GAIN AND LOCK RANGE SELECT
SYNTHESIZER RANGE DIVIDERS
PHASE DETECTOR
LOOP INTEGRATOR IH5012
SPECIAL SYMBOL (IH5012)

NOTES: TP3, TP4 MAY BE USED TO MEASURE PLL BANDWIDTH
TP5: AS PLL VARIES OVER LOCK RANGE; TP5 VARIES OVER ± 7 VDC

NOTE: UNLESS OTHERWISE SPECIFIED

LAST REF. DES. USED:
T1, R133, C60, Q41, CR17, IC41, TP5, FB3

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D COOPER	DATE 5-5-77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Salga	SEPT 8'77	TITLE SCHEMATIC VCG AND SYMMETRY
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0103-00-0612 REV B
	SCALE	CODE IDENT 23338	SHEET 3 OF 3



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROTENGR		TITLE ASSEMBLY VCG & SYMMETRY ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A DWG NO 0101-00-0612 REV
	SCALE		CODE IDENT 23338 SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG VCG	0101-00-0612	WVTK	0101-00-0612	1
NONE	SCHEMATIC VCG	0103-00-0612	WVTK	0103-00-0612	1
T1	TRANSFORMER	172-562	WVTK	1204-00-0562	1
C33 C41 C42	CAP,CER,5PF,1KV	DD-050	CRL	1500-00-5011	3
C29 C30	CAP,CER,100PF,1KV	DD-101	CRL	1500-01-0111	2
C19 C24 C27 C31 C32 C43 C55 C56 C57	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	9
C10 C12 C13 C2 C26 C28 C3 C40 C52 C53 C54	CAP,CER,.1MF,10V	UK10-104 LONG LEAD	AMCO	1500-01-0402	11
C15 C16 C18 C21 C23 C5 C6 C7 C8	CAP,CER,.1MF,20V	UK20-104LL	AMCO	1500-01-0403	9
C51	CAP,CER,15PF,1KV	DD-150	CRL	1500-01-5011	1
C35 C36	CAP,CER,.0015MF,1KV	DD-152 LONG LEAD	CRL	1500-01-5201	2
C11	CAP,CER,22PF,1KV	DD-220	CRL	1500-02-2011	1
C17 C20 C22 C25 C4 C9	CAP,CER,33PF,1KV	DD-330	CRL	1500-03-3011	6
C14	CAP,CER,47PF,1KV	DD-470	CRL	1500-04-7011	1
C1 C44 C46	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-31-0101	3
C48 C49	CAP,MYLAR,.01MF,100V	225P10391WD3	SPRAG	1500-41-0314	2
C47	CAP,TANT,1MF,35V	150D105X9035A2	SPRAG	1500-71-0502	1

WAVETEK PARTS LIST | TITLE VCG BOARD | ASSEMBLY NO. 1100-00-0612 | PAGE: 1 | REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C45	CAP,TANT,10MF,20V	150D106X9020B2	SPRAG	1500-71-0601	1
C34 C37 C38 C39 C50	CAP,TANT,22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	5
NONE	VCG BOARD	1700-00-0612	WVTK	1700-00-0612	1
NONE	SKT,IC,24PIN	DILB-24P-108	BURND	2100-03-0029	1
NONE	PC BD EJECTOR	103 YELLOW	CALMK	2800-07-0012	2
FB1 FB2 FB3	BALUN CORE	2873000902	FARIT	3100-00-0002	3
R72	POT,TRIM,100	91AR100	BECK	4600-01-0103	1
R17 R18 R20 R22 R28	POT,TRIM,100K	91AR100K	BECK	4600-01-0402	5
R67	POT,TRIM,200	91AR200	BECK	4600-02-0101	1
R33 R58 R75	POT,TRIM,20K	91AR20K	BECK	4600-02-0301	3
R21	POT,TRIM,500	91AR500	BECK	4600-05-0104	1
R34 R35 R36 R41 R43 R47 R48 R49	RES,MF,1/8W,.1%,1.5K	RN55E-1501B	TRW	4701-02-1501	8
R37 R38 R45 R46	RES,MF,1/8W,.1%,750	RN55E-7500B	TRW	4701-02-7500	4
R39 R44	RES,MF,1/8W,.1%,7.5K	RN55E-7501B	TRW	4701-02-7501	2
R87	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	1
R85 R90 R91	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	3
R129 R13 R15 R26 R27 R30 R61 R69 R70 R78 R92 R93	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	12

WAVETEK PARTS LIST | TITLE VCG BOARD | ASSEMBLY NO. 1100-00-0612 | PAGE: 2 | REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R8	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	1
R104 R111 R118	RES,MF,1/8W,1%,1.21K	RN55D-1211F	TRW	4701-03-1211	3
R68	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	1
R1 R42 R5 R51 R52 R63 R71 R89	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	8
R124 R132	RES,MF,1/8W,1%,150K	RN55D-1503F	TRW	4701-03-1503	2
R66 R74	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW	4701-03-1781	2
R7	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	1
R116 R117 R119 R121 R131 R133 R57 R74	RES,MF,1/8W,1%,2K	RN55D-2001F	TRW	4701-03-2001	8
R105	RES,MF,1/8W,1%,20.5K	RN55D-2052F	TRW	4701-03-2052	1
R128	RES,MF,1/8W,1%,21.5K	RN55D-2152F	TRW	4701-03-2152	1
R88 R94 R95 R96 R98	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	5
R3	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	1
R23 R31 R32 R50 R53 R54 R55 R86	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	8
R62 R77	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	4701-03-2492	2
R113 R115	RES,MF,1/8W,1%,274	RN55D-2740F	TRW	4701-03-2740	2
R123 R24	RES,MF,1/8W,1%,301K	RN55D-3013F	TRW	4701-03-3013	2

WAVETEK PARTS LIST | TITLE VCG BOARD | ASSEMBLY NO. 1100-00-0612 | PAGE: 3 | REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R110	RES,MF,1/8W,1%,35.7K	RN55D-3572F	TRW	4701-03-3572	1
R65 R80	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	2
R108 R109 R112 R114	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	4
R120	RES,MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	1
R106 R107 R16 R64 R81	RES,MF,1/8W,1%,499	RN55D-4990F	TRW	4701-03-4990	5
R10 R11 R12 R150 R4 R6	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	6
R19 R25 R29	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	3
R82	RES,MF,1/8W,1%,61.9	RN55D-61R9F	TRW	4701-03-6199	1
R126	RES,MF,1/8W,1%,63.4K	RN55D-6342F	TRW	4701-03-6342	1
R40 R56	RES,MF,1/8W,1%,69.8K	RN55D-6982F	TRW	4701-03-6982	2
R2 R60	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	2
R73 R83 R84	RES,MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	3
R127	RES,MF,1/8W,1%,90.9K	RN55D-9092F	TRW	4701-03-9092	1
R125	RES,MF,1/8W,1%,9.53K	RN55D-9531F	TRW	4701-03-9531	1
R100 R101 R102 R103 R122 R99	RES,MF,1/4W,1%,1M	RN60D-1004F	TRW	4701-13-1004	6
R14 R9 R97	RES MODULE	4310M-101-103	BOURN	4770-00-0008	3
CR17	DIODE	1N4581	MICRO	4801-01-4581	1

WAVETEK PARTS LIST | TITLE VCG BOARD | ASSEMBLY NO. 1100-00-0612 | PAGE: 4 | REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
CR1 CR10 CR16 CR2 CR4 CR5 CR6 CR7 CR8 CR9	DIODE	FD-6666	FAIR	4807-02-6666	10
CR11 CR12 CR13 CR14 CR15 CR3	DIODE	5082-2811	HP	4809-02-2811	6
Q2	TRANS	2N3646	FAIR	4901-03-6460	1
Q28 Q31 Q36	TRANS	2N3903	FAIR	4901-03-9030	3
Q37 Q38	TRANS	2N3905	FAIR	4901-03-9050	2
Q29	TRANS	2N4248	FAIR	4901-04-2480	1
Q24	TRANS	2N5139	FAIR	4901-05-1390	1
Q1 Q10 Q11 Q12 Q14 Q15 Q17 Q18 Q19 Q20 Q21 Q23 Q3 Q39 Q4 Q40 Q41 Q5 Q6 Q7 Q8 Q9	TRANS	2N5462	NSC	4901-05-4620	22
Q22 Q30 Q32 Q33 Q34 Q35	TRANS	2N5485	NSC	4901-05-4850	6
Q13 Q16	TRANS	SD215DE	SIG	4902-00-2140	2
Q25 Q26 Q27	TRANS,SEL,2N5462 QTY:1:14901-05-4620	142-561-55	WVTK	4998-00-0008	3
IC37 IC38 IC6	IC	LM 301AN	NSC	7000-03-0100	3
IC15 IC16 IC17 IC18 IC19 IC20 IC21	IC,OP-AMP	LF356N	NAT	7000-03-5600	7
IC9	IC	AD563J	ANDEV	7000-05-6300	1

WAVETEK PARTS LIST | TITLE VCG BOARD | ASSEMBLY NO. 1100-00-0612 | PAGE: 5 | REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
IC39 IC40	IC	1H5012	INTSL	8000-50-1200	2
IC29 IC30	IC	74LS00	TI	8000-74-0010	2
IC33	IC	7404	TI	8000-74-0400	1
IC14	IC	7416	SIG	8000-74-1600	1
IC41	IC	7426	TI	8000-74-2600	1
IC23	IC	74LS428	SIG	8000-74-4210	1
IC36	IC	MC12040	MOT	8001-20-4000	1
IC22	IC	74LS132	TI	8007-41-3210	1
IC1 IC7	IC	74LS1398	SIG	8007-41-3910	2
IC10 IC11 IC12 IC31 IC32	IC	74LS1458	SIG	8007-41-4510	5
IC34	IC	74LS151	TI	8007-41-5110	1
IC13 IC2 IC3 IC4 IC5 IC8	IC	74LS175	TI	8007-41-7510	6
IC24 IC25 IC26 IC27 IC28	IC	74LS196	SIG	8007-41-9610	5

WAVETEK PARTS LIST | TITLE VCG BOARD | ASSEMBLY NO. 1100-00-0612 | PAGE: 6 | REV C

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST VCG & SYMMETRY
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 1100-00-0612 / REV C
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP
D	R3 WAS 2K, ICC2-8 & 15 WERE COMMON, "SGL-1" WAS "MD108"	TLF	4/20/77	

LOOP FILTERS

VCO LINEARIZER

35 MHz VCO MODULE

÷ 35 TO 47 LOGIC

÷ 2

TTL+5V

+5V

-5V

+15V

-15V

(18A) MC0.5

(5A) A0-0

(4A) A1-0

(3A) A2-0

(2A) A3-0

(1A) STRB 0

(7A) D7-0

(8A) D6-0

(9A) D5-0

(10A) D4-0

17.5 TO 23.5 MHz

(2D8) DIGI-1

DIGI-Ø

470Ω SIP

(8) ICC5

+5.5 dBm 1.3V P-P

(33,34,A,B) +15V

(19,20,A,B) +5V

(26,27,28,A,B) COM

(22,23,24,A,B) COM

(50,A,B) -5V

(30,31,A,B) -15V

LOGIC COM

ICE2 74188A PROM NO. 8600-00-0007

DIG 1/MIXER PCB
DIGIT 1 SUBSYS.

Ⓑ R1 (499Ω) IS OPTIONAL, "DO NOT INSTALL".

Ⓐ R54 AND R55 (78.7Ω) ARE OPTIONAL, "DO NOT INSTALL"

6. LAST REFFERENCE DESIGNATORS USED: L14, T1, CR6, R66, C54
5. COIL FORMS; CAMBION 2173-X-3; X=2 FOR < 20Mc, X-3 FOR > 20Mc
4. FERRITE BEADS (REF. DES. "F.B.") NO. 56-590-65/3B
3. ALL RESISTORS IN OHMS; 1/8W, 1%
2. ALL CAPACITORS ARE MICROFARADS
1. ALL DIODES ARE FD6666

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 7-6-76	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR Tom Salga	SEPT 7'77	TITLE SCHEMATIC DIG 1 MIXER PCB.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO 172A	DWG NO 0103-00-0509 REV D
	SCALE	CODE IDENT 23338	SHEET 1 OF 2

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REV	ECN	BY	DATE	APP

OUTPUT LPF

OUTPUT DRIVER

(1D1) DIG1-0 P1 -1dBm ½V P-P

DIG1-1 P1

OUTPUT MIXER SBL-1 — LO IF, ICB8 COM, RF

+5BUS 4.7V F.B.

-15V C25 .01 R37 4.99K -.8V C26 .01 R38 40.2 Q2 (B8) 2N3903 +4.0V

R40 249Ω C27 .01

L5 3.3uh,10% C28 56PF SM C29 56PF SM

R32 15 R28 68.1 R33 15

TYP -11dBm 65mV RMS TP5

L6 3.3uh,10% C30 56PF SM C31 56PF SM C32 .01 C33 0.1

R50 249

ICB9 MC10116(1/3) VBB

C34 .01

(16) R51-7 470Ω R51-6 470Ω

(1) ICB9 MC10116(2/3)

.8V P-P

R52 78.7 R53 78.7 R54 78.7 R55 78.7

R51-3 470Ω R51-4 470Ω R51-10 470Ω R51-9 470Ω

SYNOA (47A,47B)

SYNOB (46A,46B)

SYNOC (43A,43B)

SYNOD (42A,42B)

(38A,38B) MC30-0

(30A,30B) MC30-1

R29 499 R30 124 R31 499 R35 499 R34 499

ICB6 MC10116(2/3) R36 249

L7 (D6)

+3.6dBm 360mV RMS TP2

C37 30PF, SM

R39 499Ω C39 100PF SM C40 .01

ICB6 MC10116(2/3) VBB

ECL R45 499 C45 .01 R46 150

R44 150

(36A,36B) DIG 23-0

(35A,35B) DIG 23-1

L8 10uh C43 .001 C38 150PF SM C42 150PF SM C41 .01

ICB7 LM1496 MIXER — CAR, OUT, SIG, -V GAIN, B

R41 249Ω R43 249Ω R48 499 R47 2.21K R42 2.21K R49 4.99K C44 .01 C46 .001

C48 15PF, SM R56 6.19K L11 (A7) C47 .01

C49 20PF, SM C50 .001 L12 (B7) R57 40.2Ω Q1 (C7) 2N3903

-11dBm 60mV RMS@ 34.5MHz TP3

C52 20PF, SM R60 6.19K L13 (B8) C54 .01

C53 20PF, SM L14 (A8) TP4 -3.5dBm @ 34.5MHz 150mV RMS

R59 90.9 R58 3.01K C51 .01

+5V P1 L9 82uh C35 22/15V C55 .1/10V +5V TO MC 10116

-15V L10 82uh C36 22/15V

F.B.

+5V BUS

-15V BUS

-15V FIRST MIXER

34.5MHz BPF

10dB BUFFER

DIG 1/MIXER PCB. MIXER AND LPF SUBSYS.

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 10-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga	SEPT 7'77	TITLE SCHEMATIC DIG 1 MIXER PCB.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO. 172A	DWG NO. 0103-00-0509 REV D
	SCALE	CODE IDENT 23338	SHEET 2 OF 2

DIG 1 PHASE DET

DIG 1 LOOP FILTER

CTR

DIG DIV LOGIC

VCO BUFF

A1

30 MHZ BPF

34.5 MHZ BPF

OUTPUT MIXER

INPUT MIXER

LPF

OUTPUT BUFF

DIGIT 1-MIXER

ASSEMBLY

REV

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR		TITLE: ASSEMBLY DIGIT 1 / MIXER ASSY.
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0509 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
ONE	ASSY DRWG,DIGIT 1	0101-00-0509	WVTK	0101-00-0509	1
ONE	SCHEMATIC,DIGIT 1	0103-00-0509	WVTK	0103-00-0509	1
1	TRANSFORMER	172-537	WVTK	1204-00-0537	1
7	COIL,30MC BPF	172-545	WVTK	1204-00-0545	1
11	COIL,35MC BPF	172-546	WVTK	1204-00-0546	1
12	COIL,35MC BPF	172-547	WVTK	1204-00-0547	1
13	COIL,35MC BPF	172-548	WVTK	1204-00-0548	1
14	COIL,35MC BPF	172-549	WVTK	1204-00-0549	1
1	35/40 MHZ VCO MODULE	172-519	WVTK	1206-00-0519	1
ONE	SHIELD	1400-00-6171	WVTK	1400-00-6171	3
ONE	SHIELD	1400-00-6181	WVTK	1400-00-6181	1
ONE	SHIELD,SYNTH	1400-00-6193	WVTK	1400-00-6193	1
03 C46 C50	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	3
18 C20 C25 C26 C27 32 C34 C40 C41 C44 45 C47 C51 C54 C8	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	15
1 C2 C22 C23 C3 C33 4 C55	CAP,CER,.1MF,10V	UK10-104	ARCO	1500-01-0412	8
10 C21 C24 C9	CAP,CER,.1MF,20V	UK20-104	ARCO	1500-01-0413	4

REFERENCE DESIGNATORS	PART DESCRIPTION	OR
NONE	SKT,IC,16PIN	DI
NONE	STANDOFF	SS
NONE	PC BD EJECTOR	10
NONE	BALUN CORE	26
R3	POT,TRIM,100K	91
R10 R24 R25 R9	RES,MF,1/8W,1%,1K	RN
R66	RES,MF,1/8W,1%,11K	RN
R30	RES,MF,1/8W,1%,124	RN
R44 R46	RES,MF,1/8W,1%,150	RN
R5	RES,MF,1/8W,1%,1.5K	RN
R11	RES,MF,1/8W,1%,15K	RN
R32 R33	RES,MF,1/8W,1%,15	RN
R16	RES,MF,1/8W,1%,1.78K	RN
R21 R26	RES,MF,1/8W,1%,21.5	RN
R42 R47	RES,MF,1/8W,1%,2.21K	RN
R12	RES,MF,1/8W,1%,23.7K	RN
R18 R36 R40 R41 R43 R50	RES,MF,1/8W,1%,249	RN

WAVETEK PARTS LIST	TITLE PCA,FIRST DIGIT MIX	ASSEMBLY NO. 1100-00-0509 PAGE: 1	REV D

WAVETEK PARTS LIST	TITLE PCA,FIRST DIGIT MIX

FERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
6	CAP,CER,.0022,1KV	DD-222 LONG LEAD	CRL	1500-02-2201	1
9	CAP,MICA,100PF,500V	DM15-101J	ARCO	1500-11-0100	1
2 C48	CAP,MICA,15PF,500V	DM15-150J	ARCO	1500-11-5000	2
8 C42	CAP,MICA,150PF,500V	DM15-151J	ARCO	1500-11-5100	2
9 C52 C53	CAP,MICA,20PF,500V	DM15-200J	ARCO	1500-12-0000	3
7	CAP,MICA,30PF,500V	DM15-300J	ARCO	1500-13-0000	1
	CAP,MICA,470PF,500V	DM15-471J	ARCO	1500-14-7100	1
8 C29 C30 C31	CAP,MICA,56PF,500V	DM15-560J	ARCO	1500-15-6000	4
1	CAP,MYLAR,.01MF,100V	225P10391WD3	SPRAG	1500-41-0314	1
	CAP,MLAR,.0047MF100V	225P47291WD3	SPRAG	1500-44-7204	1
3 C14 C15 C17 C19 5 C36	CAP,TANT,.22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	7
NE	DIGIT 1 MIXER	1700-00-0509	WVTK	1700-00-0509	1
L2	CHOKE,1000MIC H,5%	2500-28	DLVAN	1800-00-0004	2
0 L4 L9	CHOKE,82MH,5%	1537-72	DLVAN	1800-00-0005	3
L6	CHOKE,3.3MH,10%	1537-24	DLVAN	1800-00-0006	2
	CHOKE,10MH,10%	1537-36	DLVAN	1800-00-0007	1
	CHOKE,200MH,5%	1537-90	DLVAN	1800-00-0008	1

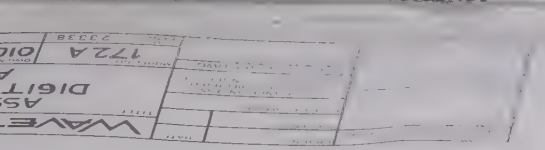
REFERENCE DESIGNATORS	PART DESCRIPTION	OR
R58	RES,MF,1/8W,1%,3.01K	RN
R13	RES,MF,1/8W,1%,30.1K	RN
R38 R57	RES,MF,1/8W,1%,40.2	RN
R29 R31 R34 R35 R39 R45 R48	RES,MF,1/8,1%,499	RN
R17 R37 R49	RES,MF,1/8W,1%,4.99K	RN
R19 R20 R7 R8	RES,MF,1/8W,1%,51.1	RN
R15 R2 R4	RES,MF,1/8W,1%,576	RN
R56 R60	RES,MF,1/8W,1%,6.19K	RN
R14	RES,MF,1/8W,1%,681	RN
R28	RES,MF,1/8W,1%,68.1	RN
R6	RES,MF,1/8W,1%,7.5K	RN
R52 R53	RES,MF,1/8W,1%,78.7	RN
R59	RES,MF,1/8W,1%,90.9	RN
R22 R51	RES MODULE	43
R23	RES MODULE 2.2K	43
CR2 CR3 CR4 CR5 CR6	DIODE	FD
Q1 Q2	TRANS	2N

WAVETEK PARTS LIST	TITLE PCA,FIRST DIGIT MIX	ASSEMBLY NO. 1100-00-0509 PAGE: 2	REV D

WAVETEK PARTS LIST	TITLE PCA,FIRST DIGIT MIX

NOTE: UNLESS OTHERWISE SPECIFIED

8 | 7 | 6 | 5



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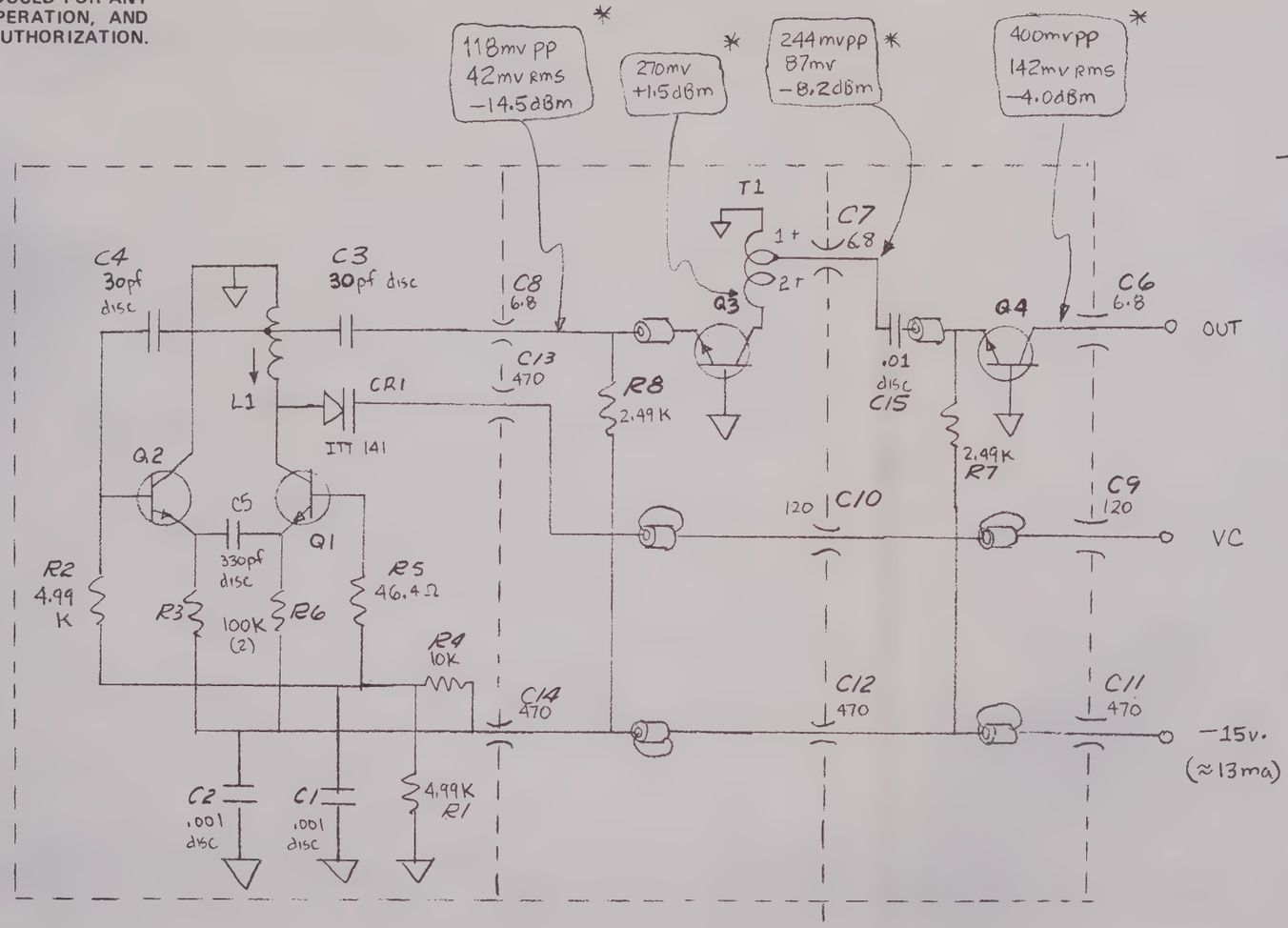
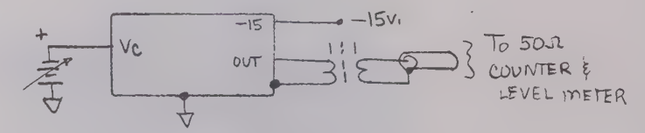
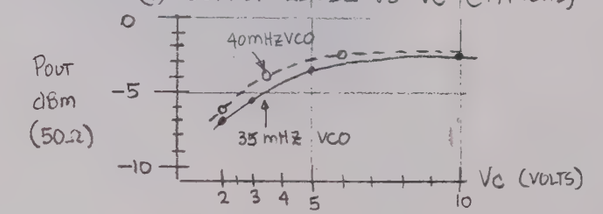
REV	ECN	BY	DATE	APP
A	LOOP2 Added	TVS	18 May	
B	ADD T1, DELETE +5V	TVS	26 May	
C	TUNE UP / TEST DATA	TVS	20 JULY	



TUNE UP & TEST DATA



(1) OUTPUT LEVEL VS Vc (TYPICAL)



(2) TUNE UP & TEST DATA:

	Vc	FOUT	COMMENTS
DIGIT 1 VCO	3.0v.	35 ± 0.1 mHz	TUNE L1 FOR THIS
	5.0v	39.4 ± 0.3	CHECK POINT
	10.0v	47.5 ± 1.5	" "
DIGIT 2 VCO	3.5v.	40. ± 0.1 mHz	TUNE L1 FOR THIS
	6.0v.	45.9 ± 0.35	CHECK POINT
	10v.	53.1 ± 1.5	" "

* FOR 40 mHz VCO and Vc = 3.50v & 50Ω LOAD; TYPICAL VALUES ONLY

Q1 - Q4: 2N3563 (PRE-TESTED)

L1: 14t, TAP AT 1¼t; ON CAMBION FORM

T1: 3t, TAP AT 1t on FAIR-RITE 2873002402

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN TVS	DATE 16 Apr	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR J. Kolb / TVS	SEPT 8 77	TITLE 35/40 mHz VCO MODULE (FOR DIG1 & DIG23 LOOPS)
	RELEASE APPROV	1976	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172 / DWG NO. 0104-00-0519 / REV C
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

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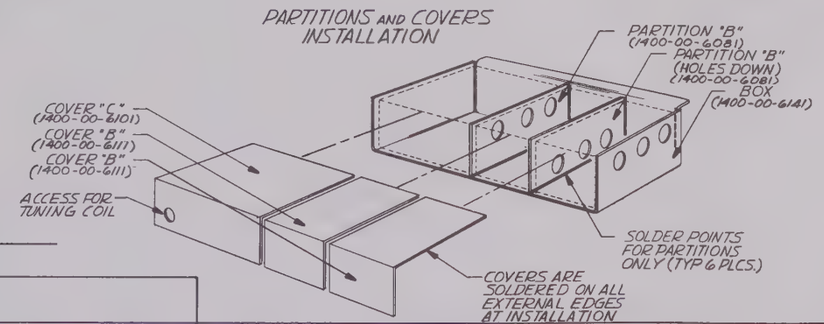
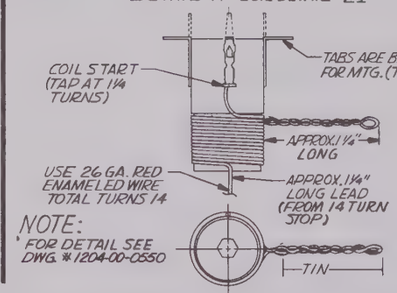
REV	ECN	BY	DATE	APP

PARTITIONS AND COVERS INSTALLATION

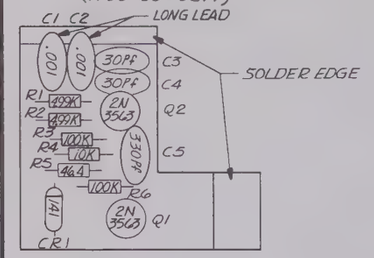

PARTITION "B" (1400-00-6081)
PARTITION "B" (HOLES DOWN) (1400-00-6081)
BOX (1400-00-6141)
COVER "C" (1400-00-6101)
COVER "B" (1400-00-6111)
COVER "B" (1400-00-6111)
ACCESS FOR TUNING COIL
SOLDER POINTS FOR PARTITIONS ONLY (TYP 6 PLCS.)
COVERS ARE SOLDERED ON ALL EXTERNAL EDGES AT INSTALLATION

DETAIL "A" COIL DETAIL L1


COIL START (TAP AT 1¼ TURNS)
TABS ARE BENT 90° FOR MTG. (TYP. 4)
APPROX. 1¼" LONG
USE 26 GA. RED ENAMELED WIRE TOTAL TURNS 14
APPROX. 1¼" LONG LEAD (FROM 14 TURN STOP)
TIN

NOTE: * FOR DETAIL SEE DWG. * 1204-00-0550

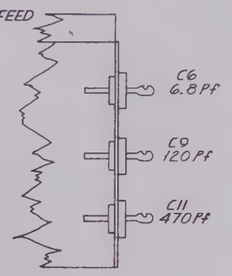
P.C. BOARD COMPONENT INSTALL. (1700-00-0519)



ASSEMBLY SEQUENCE

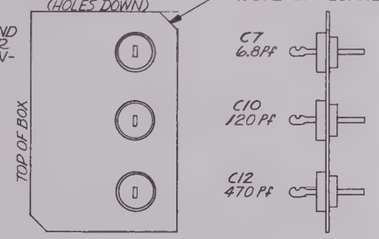
- STEP 1 SOLDER CORNERS OF BOX

- STEP 2 INSTALL FEED THRU CAPACITORS ON BOX

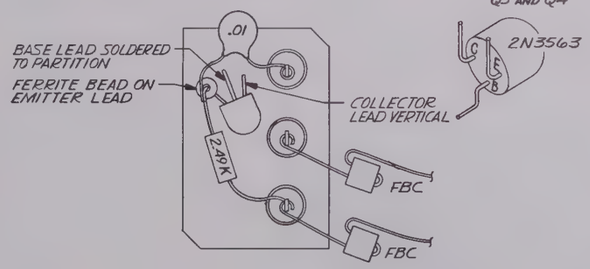


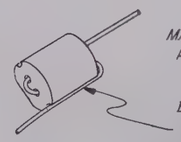
- STEP 3 INSTALL FEED THRU CAPACITORS ON PARTITION "B" (HOLES DOWN)

NOTE: SEE PARTITION AND COVER DETAIL FOR CAPACITOR ORIENTATION OF THIS PARTITION



- STEP 4 INSTALL COMPONENTS ON PARTITION "B"



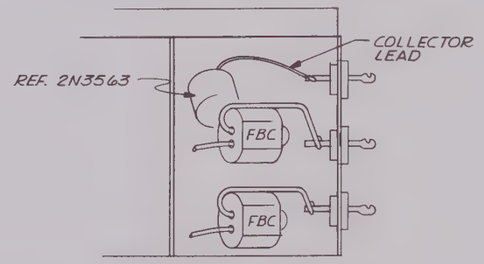


MAKE FERRITE CORE ASSEMBLIES:
A) CUT A LENGTH OF 22 GA. BUS WIRE 3" LONG, FOLD IN HALF
B) INSERT THRU THE TWO HOLES IN FERRITE BALUN CORE AND BEND ONE END OF WIRE BACK ALONG ONE SIDE OF CORE AS SHOWN

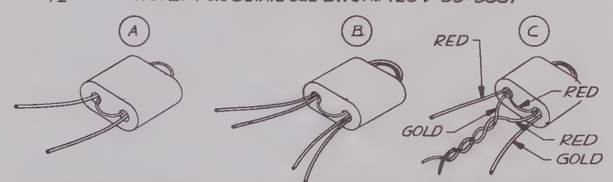
NOTE: UNLESS OTHERWISE SPECIFIED

- STEP 5 SOLDER COMPLETED PARTITION INTO PLACE IN BOX USING COVER B AS A SPACER. IT WILL BE NECESSARY TO BEND LEADS FROM PARTITION OUT OF THE WAY TO INSTALL COVER.

- STEP 6 CONNECT WIRES FROM PARTITION TO BOX



- STEP 7 "T1" ASSEMBLE TRANSFORMER ON FERRITE BALUN CORE
NOTE: FOR DETAIL SEE DWG. * 1204-00-0551



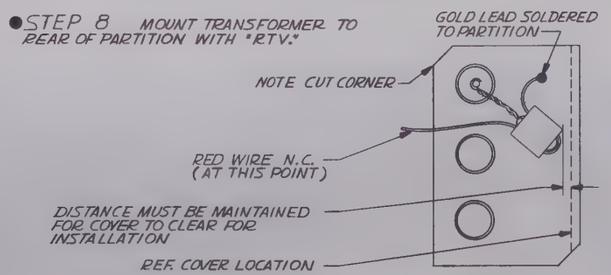
PUT 2 TURNS OF NO. 28 GA. RED ENAMELED WIRE THRU BOTH HOLES OF CORE WITH 1" OF LEAD LEFT AT EACH END

ADD 1 TURN OF NO. 28 GA. GOLD ENAMELED WIRE THRU BOTH HOLES LEAVING 1" LEADS

TWIST TOGETHER GOLD LEAD FROM ONE HOLE WITH RED LEAD FROM OTHER HOLE

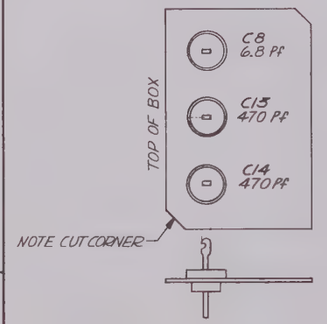
NOTE; AT COMPLETION OF STEP "C" TIN LEADS BY DIPPING IN SOLDER POT TO WITHIN 3/16" OF CORE. HOLD CORE WITH SUITABLE PLIERS TO AVOID BURNING FINGERS. DO NOT TIN TO CLOSE TO CORE, OR HOLD IN SOLDER POT TOO LONG, OR YOU WILL NOT BE ABLE TO DETERMINE COLOR OF WIRE PRIOR TO TINNING.

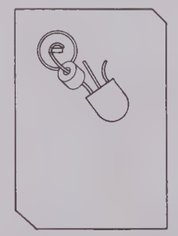
- STEP 8 MOUNT TRANSFORMER TO REAR OF PARTITION WITH "R.T.V."


GOLD LEAD SOLDERED TO PARTITION
NOTE CUT CORNER
RED WIRE N.C. (AT THIS POINT)
DISTANCE MUST BE MAINTAINED FOR COVER TO CLEAR FOR INSTALLATION
REF. COVER LOCATION

- STEP 9 MOUNT TWO FERRITE CHOKES TO THE TWO REMAINING FEED THRU CAPACITORS MOUNTED IN THE BOX

- STEP 10 ASSEMBLE NEXT PARTITION.





A) BASE LEAD SOLDERED TO PARTITION
B) COLLECTOR LEAD VERTICAL (SEE STEP 4 FOR REF.)

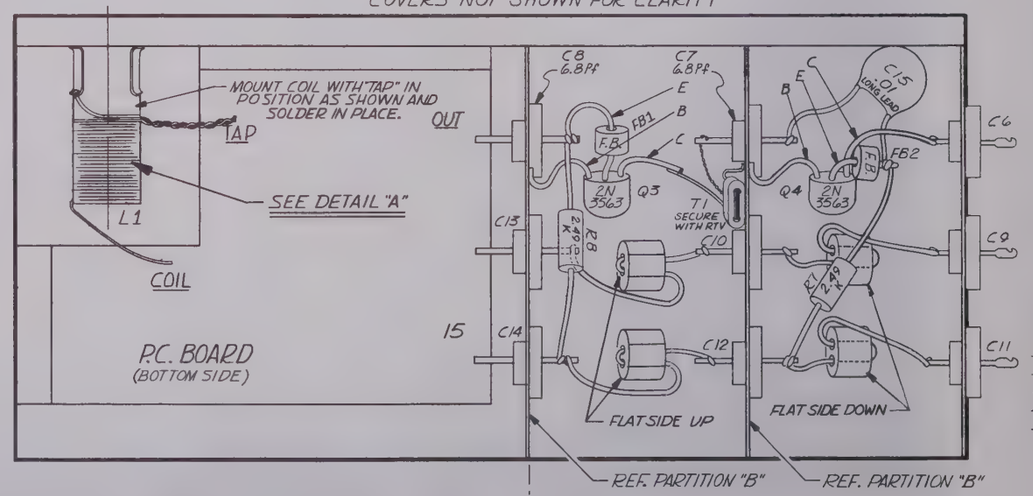
- STEP 11 INSTALL PARTITION IN BOX USING COVER AS SPACER, JOIN WIRES FROM FIRST PARTITION TO SECOND PARTITION.

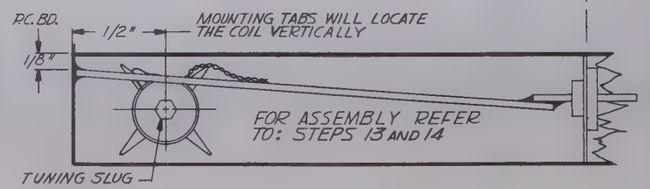
- STEP 12 ASSEMBLE P.C. BOARD.

- STEP 13 MOUNT COIL IN BOX

- STEP 14 MOUNT P.C. BOARD IN BOX AND CONNECT TO COIL. NOTE THAT THE P.C. BOARD MUST BE INSTALLED AT ANGLE SHOWN FOR TUNING ACCESS OF COIL

COVERS NOT SHOWN FOR CLARITY





DRAWN D. COOPER	DATE 7-27-76	WAVETEK SAN DIEGO, CALIFORNIA	
PROJ ENGR Tom Salyer	BERT 8-17-77	TITLE ASSEMBLY 35 40 MHz VCO MODULE	
RELEASE APPROV			
TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030			
DO NOT SCALE DWG		MODEL NO. 172 A	DWG NO. 0102-00-0519 REV
SCALE		CODE IDENT 23338	SHEET 1 OF 1

6150-00-2200

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,VCO MOD	0102-00-0519	WVTK	0102-00-0519	1
NONE	SCHEMATIC,VCO MOD	0104-00-0519	WVTK	0104-00-0519	1
L1	COIL,35MHZ VCO	172-550	WVTK	1204-00-0550	1
T1	TRANSFORMER	172-551	WVTK	1204-00-0551	1
NONE	PARTITION "B"	1400-00-6081	WVTK	1400-00-6081	2
NONE	COVER "C"	1400-00-6101	WVTK	1400-00-6101	1
NONE	COVER "B"	1400-00-6111	WVTK	1400-00-6111	2
NONE	BOX,OSCILLATOR	1400-00-6141	WVTK	1400-00-6141	1
C1 C2	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	2
C15	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	1
C3 C4	CAP,CER,30PF,1KV	DD-300	CRL	1500-03-0001	2
C5	CAP,CER,330PF,1KV	DD-331	CRL	1500-03-3111	1
C10 C9	CAP,FTHRU,120PF,500V	FA5C-1211 1	AB	1500-61-2106	2
C11 C12 C13 C14	CAP,FTHRU,470PF,500V	FA5C-4712	AB	1500-64-7106	4
C6 C7 C8	CAP,FTHRU,6.8PF,500V	FA5C-6892	AB	1500-66-8906	3
NONE	VCO MOD	1700-00-0519	WVTK	1700-00-0519	1
FB1 FB2	FERRITE BEAD	56-590-65/36	FERRX	3100-00-0001	2
NONE	BALUN CORE	2873000902	FAMIT	3100-00-0002	4

WAVETEK PARTS LIST | TITLE 35/40 MHZ VCO MODULE | ASSEMBLY NO. 1206-00-0519 | PAGE: 1 | REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R4	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	1
R3 R6	RES,MF,1/8W,1%,100K	RN55D-1003F	TRW	4701-03-1003	2
R7 R8	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	2
R5	RES,MF,1.8W,1%,46.4	RN55D-46R4F	TRW	4701-03-4649	1
R1 R2	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	2
CR1	DIODE	141	ITT	4803-02-0141	1
Q1 Q2 Q3 Q8	TRANS	2N3563	FAIR	4901-03-5630	4

WAVETEK PARTS LIST | TITLE 35/40 MHZ VCO MODULE | ASSEMBLY NO. 1206-00-0519 | PAGE: 2 | REV

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST 35/40 MHz VCO MODULE DIGIT 1/ MIXER
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 1206-00-0519 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP
E	"SBL-1" WAS "MD108"	TLF	6-30-77	

MC4044 · ICG4 74LS139 · ICG3 74LS192 · 74S02 · 74L140 · ICF1 · 7474 · ICE1 · ICE3 74LS192 · ICE4 74LS175 · ICF4 74LS175 · ICF3 74LS192 · ICD5 · ICD1 MC10125P · ICD6 SBL-1 · ICB1 · ICA3 LM361 · A1 VCO MODULE 35/40 MHz · ICA8 10116 · ICB8 MC 10138 · ICF11 · ICF12 · A2 VCO MODULE 60.4 MHz · VR1 7805 · T1 · T2 · T3 · T4 · T5 · Q1 2N3903 · Q2 2N3903 · CR1 · CR2 · CR3 · CR4 · CR5 · CR6 · CR7 HP2811 · L1 2200uh · L2 2200 uh · L3 1000uh 5% · L4 0.47uh 10% · L5 0.47uh 10% · L6 0.18uh 10% · L7 0.18uh 10% · L8 2200uh · L9 82uh

+15V -15V +5V +5 TTL +5 MECL -5V

SYN45-1(16,A,B) → SYN45-1 (B5)
COM45 (17,A,B) → COM45 (B5)
A0-0 (5A) · A1-0 (4A) · A2-0 (3A) · A3-0 (2A) · STRB-0 (1A)
D3-0 (11A) · D2-0 (12A) · D1-0 (13A) · D0-0 (14A)
D7-0 (7A) · D6-0 (8A) · D5-0 (9A) · D4-0 (10A)
CLR-0 (25,A,B)
SYN45-1 (C8) · COM45
CTR 100K (C5) · MC01' (21,A,B)
ICD5-1,16 · ICD5-8 · SL60.5-1 (C1) · SL60.5-0 (C1)
SL60.5-1 (C5) · SL60.5-0 (C5)
TO GND PLANE
(33,34,A,B) +15V
(19,20,A,B) +5V
(26,27,28,A,B) COM
(22,23,24,A,B) COM
(50,A,B) -5V
(30,31,A,B) -15V
(36,A,B) DIG 23-1
(35,A,B) DIG 23-0
(46 A,B) MC 60-0
(47 A,B) MC 60-COM
OPEN LOOP TEST
PUP

2. ALL CAPS ARE IN μF.
1. ALL RESISTORS ARE IN Ω.
NOTE: UNLESS OTHERWISE SPECIFIED

4. TUNE VCO FOR 60.3 ± .01 MHz WITH TP6 GROUNDED; CONNECT 50Ω COUNTER DIRECTLY BETWEEN VCO OUTPUT AND GROUND.

3. INDICATES FERRITE BEAD.

5. ALL UNMARKED DIODES ARE FD6666

LAST REF DES USED
C68, R71, T5, L9, CR7, Q2 TP6

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN BA	DATE 7-6-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga	SEPT 7'77	TITLE: SCHEMATIC DIGIT 2 & 3
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ±1° .XX ± .030		
	DO NOT SCALE DWG		MODEL NO. 172A · DWG NO. 0103-00-0500 · REV E
	SCALE		CODE IDENT 23338 · SHEET 1 OF 1

DIG 23 LOOP FILTER

A1 40 MHZ VCO

DIVIDER LOGIC

AMP

LPF

DIG 23 MIXER

VCO BUFF

BALUN

MIXER—LPF

+5 REG

A2 60.4 MHZ VCO

DIGIT 2/3 TRANS LOOP ASSEMBLY REV

TRANS LOOP FILTER

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR		TITLE ASSEMBLY DIGITS 2 & 3 ASSY.
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX. 010 ANGLES 1 XX. 030		
	DO NOT SCALE DWG		MODEL NO 172A
	SCALE		DWG NO 0101-00-0500 REV
			CODE IDENT 23338 SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRAG,DIGIT 2-3	0101-00-0500	WVTK	0101-00-0500	1
NONE	SCHEMATIC,DIGIT 2-3	0103-00-0500	WVTK	0103-00-0500	1
T1 T2 T3 T5	TRANSFORMER	172-537	WVTK	1204-00-0537	4
T4	TRANSFORMER	172-539	WVTK	1204-00-0539	1
A1	35/40 MHZ VCO MODULE	172-519	WVTK	1206-00-0519	1
A2	60.4MHZ VCO MOD	172-520	WVTK	1206-00-0520	1
NONE	LOOP 2 SHIELD	1400-00-6161	WVTK	1400-00-6161	3
NONE	SHIELD,SYNTH	1400-00-6193	WVTK	1400-00-6193	1
C59 C61 C62	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	3
C11 C18 C19 C20 C21 C22 C23 C32 C35 C4 C46 C5 C51 C52 C53 C54 C55 C56 C63 C64 C66 C67 C7	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	23
C1 C14 C15 C17 C36 C37 C38 C39 C40 C44 C50 C57 C60 C65	CAP,CER,.1MF,10V	UK10-104	ARCO	1500-01-0412	14
C13 C16 C33 C34 C48	CAP,CER,.1MF,20V	UK20-104	ARCO	1500-01-0413	5
C58	CAP,CER,470PF,1KV	DD-471	CRL	1500-04-7111	1
C28 C29 C30 C31	CAP,CER,82PF,1KV	DD-820	CRL	1500-08-2011	4
C9	CAP,MICA,15PF,500V	DM15-150J	ARCO	1500-11-5000	1

WAVETEK PARTS LIST | TITLE PCA,2ND DIGIT TRANS | ASSEMBLY NO. 1100-00-0500 PAGE: 1 | REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	STANDOFF	SS5368-3C-5A	UNICP	2800-05-6114	5
NONE	PC BD EJECTOR	103 RED	CALMK	2800-07-0010	2
NONE	BALUN CORE	2873000902	FARIT	3100-00-0002	14
R9	POT,TRIM,2K	91AR2K	BECK	4600-02-0201	1
R7	RES,C,1/2W,10%,1.5M	RC20GF-155	STKPL	4700-25-1504	1
R13 R22 R23 R30 R62 R63 R65 R66	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	8
R28 R29 R58	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	3
R39 R41 R43 R47 R5 R6	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	6
R51	RES,MF,1/8W,1%,124	RN55D-1240F	TRW	4701-03-1240	1
R38	RES,MF,1/8W,1%,13K	RN55D-1302F	TRW	4701-03-1302	1
R2 R26 R27	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	3
R32 R4 R56	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	3
R11	RES,MF,1/8W,1%,2K	RN55D-2001F	TRW	4701-03-2001	1
R59 R60	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	2
R12 R18 R54 R55 R68 R69	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	6
R3	RES,MF,1/8W,1%,274	RN55D-2740F	TRW	4701-03-2740	1
R44	RES,MF,1/8W,1%,3.32K	RN55D-3321F	TRW	4701-03-3321	1

WAVETEK PARTS LIST | TITLE PCA,2ND DIGIT TRANS | ASSEMBLY NO. 1100-00-0500 PAGE: 3 | REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q1 Q2	TRANS	2N3903	FAIR	4901-03-4030	2
ICD6	IC	MD108	ANZAC	7000-01-0800	1
ICA3	IC	LM 301AN	NSC	7000-03-0100	1
ICF11 ICF12	IC	MA-741	FAIR	7000-07-4100	2
ICF1	IC	74S02	SIG	8000-74-0201	1
ICE1	IC	7474	TI	8000-74-7400	1
VR1	VOLTAGE REGULATOR	7805393	FAIR	8000-78-0500	1
ICD1	IC	MC10125P	MOT	8001-01-2500	1
IC88	IC	MC10138P	MOT	8001-01-3800	1
ICG4	IC	74LS139B	SIG	8007-41-3910	1
ICG1	IC	74S140	TI	8007-41-4001	1
ICE4 ICF4	IC	74LS175	TI	8007-41-7510	2
ICE3 ICF3 ICG3	IC	74LS192	TI	8007-41-9210	3
ICB1 ICF10	IC	MC4044P	MOT	8100-40-4400	2
ICA8 ICC9 ICD5 ICD8	IC,SEL,MC10116P QTY:118001-01-1600	8200-00-0012	WVTK	8200-00-0012	4

WAVETEK PARTS LIST | TITLE PCA,2ND DIGIT TRANS | ASSEMBLY NO. 1100-00-0500 PAGE: 5 | REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C24 C25 C26 C27	CAP,MICA,220PF,500V	DM15-221J	ARCO	1500-12-2100	4
C68	CAP,MICA,470PF,500V	DM15-471J	ARCO	1500-14-7100	1
C43	CAP,MYLAR,.001MF100V	225P10291WD3	SPRAG	1500-41-0204	1
C45	CAP,MYLAR,.01MF,100V	225P10391WD3	SPRAG	1500-41-0314	1
C6	CAP,MYLR,.0022MF100V	225P22291WD3	SPRAG	1500-42-2214	1
C10	CAP,POLY,.0025MF100V	SX225	MAL	1500-42-5204	1
C42	CAP,MLAR,.0047MF100V	225P47291WD3	SPRAG	1500-44-7204	1
C2	CAP,MYLAR,.047MF100V	225P47391WD3	SPRAG	1500-44-7314	1
C41 C47 C49 C8	CAP,TANT,22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	4
C12 C3	CAP,TANT,5.6MF,35V	150D565X9035B2	SPRAG	1500-75-6502	2
NONE	DIGIT 2,3	1700-00-0500	WVTK	1700-00-0500	1
L3	CHOKE,1000MIC H,5%	2500-28	DLVAN	1800-00-0004	1
L9	CHOKE,82MH,5%	1537-72	DLVAN	1800-00-0005	1
L1 L2 L8	CHOKE,2200MH	2500-44	DLVAN	1800-00-0010	3
L4 L5	CHOKE,.47MH,10%	1025-12	DLVAN	1800-00-0011	2
L6 L7	CHOKE,.18MH,10%	1025-02	DLVAN	1800-00-0012	2
NONE	SKT,IC,16PIN	DILB-16P-108	BURND	2100-03-0028	1
NONE	PIN,MALE	61182-2	AMP	2100-05-0020	5

WAVETEK PARTS LIST | TITLE PCA,2ND DIGIT TRANS | ASSEMBLY NO. 1100-00-0500 PAGE: 2 | REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R10 R57	RES,MF,1/8W,1%,33.2K	RN55D-3322F	TRW	4701-03-3322	2
R25	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	1
R64	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	1
R8	RES,MF,1/8W,1%,46.4K	RN55D-4642F	TRW	4701-03-4642	1
R1 R14 R16 R17 R19 R20 R48 R50 R52 R53 R61 R70 R71	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	13
R31 R34	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	2
R24	RES,MF,1/8W,1%,51.1	RN55D-51R1F	TRW	4701-03-5119	1
R49	RES,MF,1/8W,1%,5.76K	RN55D-5761F	TRW	4701-03-5761	1
R42 R45	RES,MF,1/8W,1%,681	RN55D-6810F	TRW	4701-03-6810	2
R67	RES,MF,1/8W,1%,78.7	RN55D-78R7F	TRW	4701-03-7879	1
R33 R40	RES,MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	2
R37 R46	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TRW	4701-03-8251	2
R35 R36	RES,MF,1/4W,1%,1M	RN60D-1004F	TRW	4701-13-1004	2
R15 R21	RES MODULE	4310R-101-471	BOURN	4770-00-0009	2
CR1 CR2 CR3 CR4 CR5 CR6	DIODE	FD-6666	FAIR	4807-02-6666	6
CR7	DIODE	5082-2811	HP	4809-02-2811	1

WAVETEK PARTS LIST | TITLE PCA,2ND DIGIT TRANS | ASSEMBLY NO. 1100-00-0500 PAGE: 4 | REV G

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST DIGITS 2&3
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ±1° .XX ± .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO. 1100-00-0500 / REV G
	SCALE		CODE IDENT 23338 / SHEET OF

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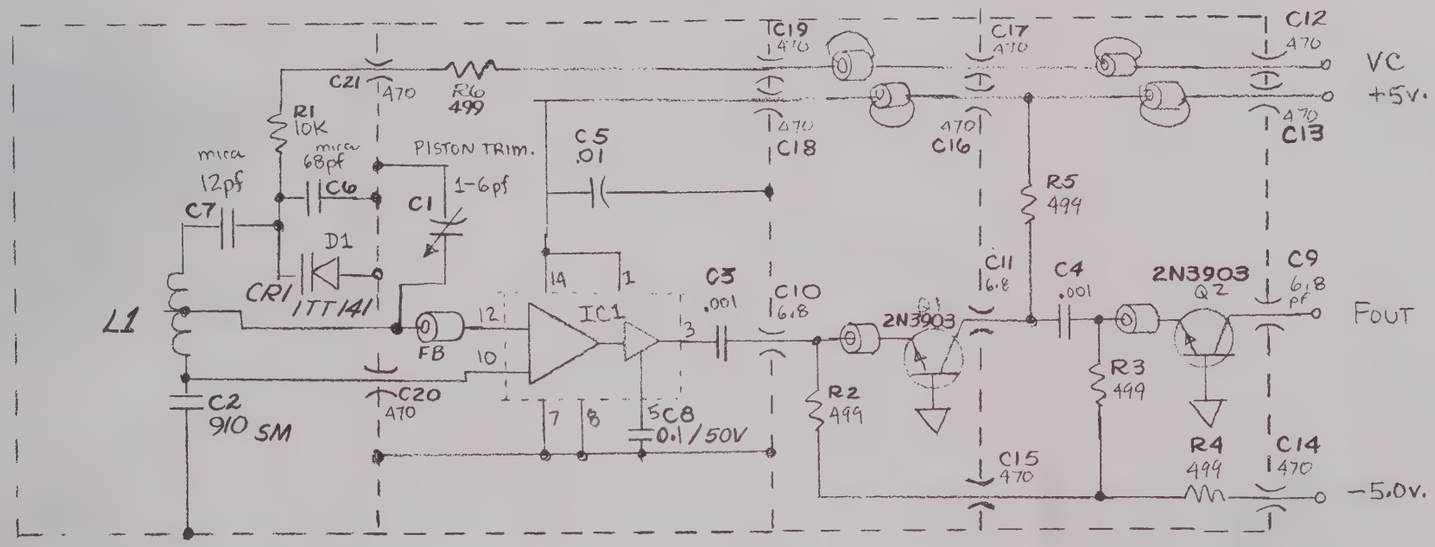
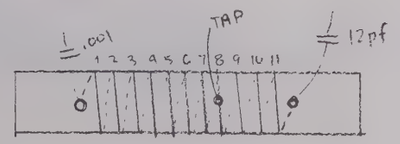
REV	ECN	BY	DATE	APP
A	PISTON TRIMMER MOVED	TVS	JUNE 76	TVS
B	CHANGED: C2 FROM .001 TO 910	DC	22377	TVS



L1: COIL DETAIL



$(\frac{1}{2}+11+\frac{1}{2})t$ ON 3/8 PLEX ROD
AS PER DWG.# 1400-00-6150

470pf fo thru: 10
6.8pf " 3

IC1: PRETESTED MC1648
Q1, Q2: " 2N3903
D1: ITT 141 DIODE

-Vcc correction : 24Feb

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN T.V. Soliga	DATE 16 Feb	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR T. V. Soliga	SEPT 8 '77	TITLE: 60.4 MHz VCO MODULE FOR SUM LOOP
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172 / DWG NO. 0103-00-0520 / REV B
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

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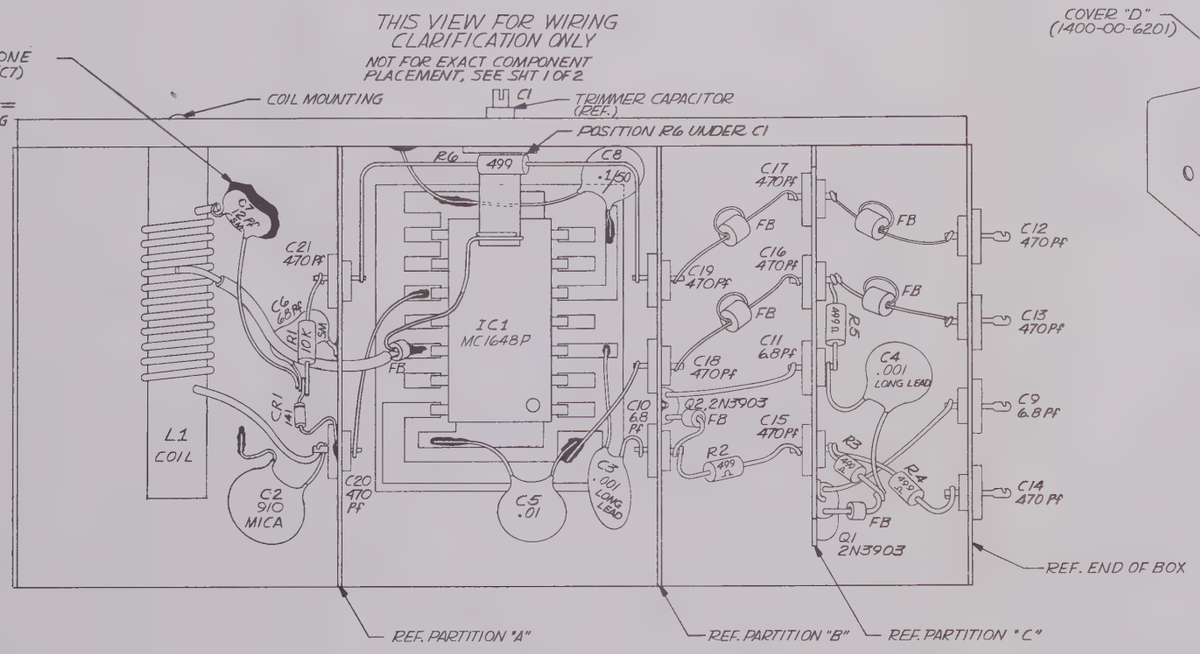
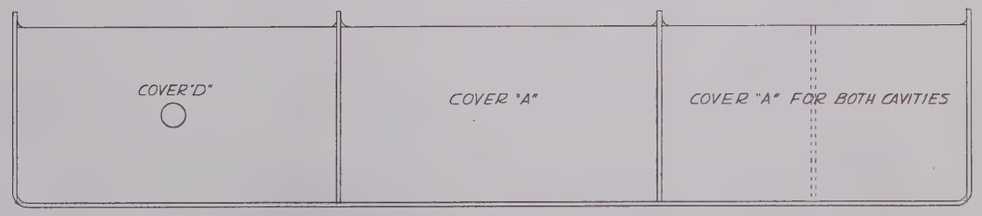
REV	ECN	BY	DATE	APP

THIS VIEW FOR WIRING CLARIFICATION ONLY

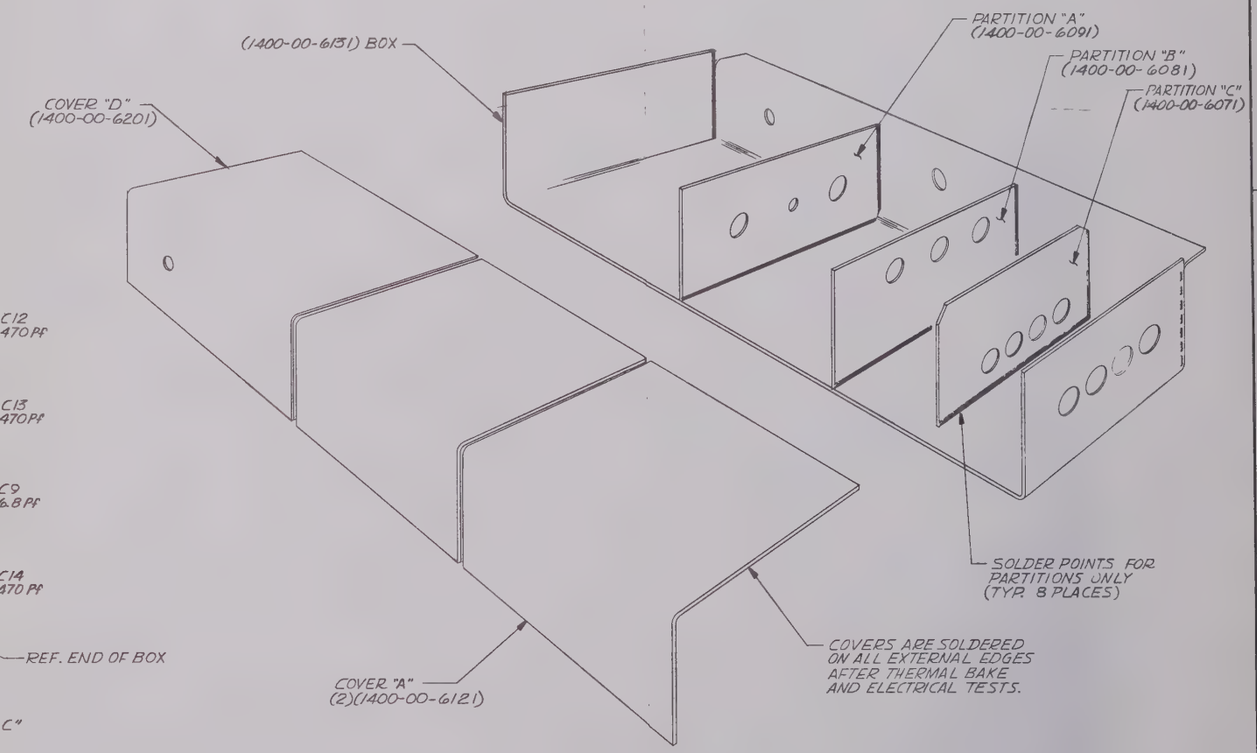
NOT FOR EXACT COMPONENT PLACEMENT, SEE SHT 1 OF 2



THIS VIEW COVERS INSTALLED



PARTITIONS AND COVERS INSTALLATION


(1400-00-6131) BOX
COVER "D" (1400-00-6201)
PARTITION "A" (1400-00-6091)
PARTITION "B" (1400-00-6081)
PARTITION "C" (1400-00-6071)
SOLDER POINTS FOR PARTITIONS ONLY (TYP. 8 PLACES)
COVERS ARE SOLDERED ON ALL EXTERNAL EDGES AFTER THERMAL BAKE AND ELECTRICAL TESTS.
COVER "A" (2)(1400-00-6121)

NOTE. UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 7-30-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga	SEPT 8'77	TITLE ASSEMBLY 60.4 MHz VCO MODULE, DIGITS 2 AND 3
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 0102-00-0520 / REV C
	SCALE		CODE IDENT 23338 / SHEET 2 OF 2

0102-00-0520

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG,VCO MOD	0102-00-00520	WVTK	0102-00-0520	1
NONE	SCHEMATIC,VCO MOD	0103-00-0520	WVTK	0103-00-0520	1
NONE	INDUCTOR,60.4MHZ	172-604	WVTK	1204-00-0604	4
NONE	PARTITION "C"	1400-00-6071	WVTK	1400-00-6071	1
NONE	PARTITION "B"	1400-00-6081	WVTK	1400-00-6081	1
NONE	PARTITION "A"	1400-00-6091	WVTK	1400-00-6091	1
NONE	COVER "A"	1400-00-6121	WVTK	1400-00-6121	2
NONE	BOX,OSCILLATOR	1400-00-6131	WVTK	1400-00-6131	1
L1	COIL FORM	1400-00-6150	WVTK	1400-00-6150	1
NONE	COVER "D"	1400-00-6201	WVTK	1400-00-6201	1
C3 C4	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	2
C5	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	1
C7	CAP,MICA,12PF,500V	DM15-120J	AMCO	1500-11-2000	1
C6	CAP,MICA,68PF,500V	DM15-680J	AMCO	1500-16-8000	1
C2	CAP,MICA,910PF,500V	DM15-911F	APCO	1500-19-1101	1
C1	CAP,PISTON TRIMMER	GSG146	SPRGO	1500-50-9000	1
C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	CAP,FTHRU,470PF,500V	FA5C-4712	AB	1500-64-7106	10

WAVETEK PARTS LIST	TITLE 60.4MHZ VCO MOD	ASSEMBLY NO. 1206-00-0520 PAGE: 1	REV 8

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C10 C11 C9	CAP,FTHRU,6.8PF,500V	FA5C-6692	AB	1500-66-8906	3
C8	CAP,CER,.1MF,50V	DG45BX104MP	KSTCP	1509-90-0011	1
NONE	60.4MHZ VCO MODULE	1700-00-0520	WVTK	1700-00-0520	1
NONE	FERRITE BEAD	56-590-65/3B	FERRX	3100-00-0001	3
R1	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	1
R2 R3 R4 R5 R6	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	5
CR1	DIODE	1N1	ITT	4803-02-0141	1
Q1 Q2	TRANS	2N3903	FAIR	4901-03-9030	2
IC1	IC	MC1648P	MOT	8100-16-4810	1

WAVETEK PARTS LIST	TITLE 60.4MHZ VCO MOD	ASSEMBLY NO. 1206-00-0520 PAGE: 2	REV 8

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJENGR		TITLE PARTS LIST 60.4MHz VCO MODULE. DIGITS 2 & 3
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 172A / DWG NO. 1206-00-0520 / REV B
	DO NOT SCALE DWG		CODE IDENT 23338 / SHEET OF
	SCALE		

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REV	ECN	BY	DATE	APP

3. ALL MC10116 IC'S ARE SELECTED (WVTK NO. 8200-00-0012)

2. CR2, CR3, CR4, CR5: HP5082-2811 MATCHED

1. TUNE FOR Vc = 1.7V AT 40.1MHz (DIGIT99) CHECK Vc = 2.0V; f = 50 ± 1.5 MHz (DIGIT 00)

NOTE UNLESS OTHERWISE SPECIFIED

LAST REF. DES. USED: R69 Q1 E6; C78 L7 XTL1; CR19 T3 TP4; 1 ONLY

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN Ro	DATE SEPT 7'77	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Saliga		TITLE DIGITS 4 5 .SCP; DIG 4/5 REF PCB SCHEMATIC
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172A; DWG NO 0103-00-0501; REV E
	SCALE		CODE IDENT 23338; SHEET 1 OF 2

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REV	ECN	BY	DATE	APP

+5V TTLA — P.1
+15V — P.1 — +15
-15V — P.1 — -15

REF/OSC & VCXO
CRYST GLUED INSULTD PCB
SPRAY PROTECTED
XTL 1
L2 14T
C34 39 pf SM 5%
C35 68 pf, 5% SM
C36 .001
C37 82 pf SM 5%
R13 49.9K
CR9 MV2109
J1
VC10 B1
VCGRD-A2
-1.15 VDC
Q1 2N3903
R14 2.21K
R15 10K
R16 100Ω
C38 39 pf SM 5%
T2
CR6
C41 .01
C42 .01
-15
-.58 VDC
C43 .01
R17 301Ω
R18 51.1Ω
R19 249Ω
ICA10
C44 .01
C45 30 pf SM
C46 100 pf SM
C47 .01 pf
C75 TRIM
L3
R22 499Ω
+5TTL
TP3 -8±1 dBM 30 MHz
FB
USE HI-Z PROBE ONLY
+1 dBM (0.6Vpp) 10. MHz
TP2
C39 .1 10V
C40 22 uf/15V
C49 .01
C50 22 uf/15V
(1) (16) (8)

X3 MULT
X2 MULT
ICA10 10116
ICA12 R23-2 470Ω
R24 100Ω
C51 15 pf
R25 100Ω
CR7 2811 (2)
CR8
R26 249Ω
R27 200Ω
IC A12
R28 4.99K
R29 499Ω
R30 499Ω
C52 .01
R23-3 470Ω
R23-4 470Ω
R23-5 470Ω
ICA10
VBB
-9±1.5 dBM 60MHz
TP4
L4
C53 15 pf SM
C54 82 pf SM
C55 .001
R31 150Ω
R32 499Ω
ICA12
R23-8 470Ω
R23-9 470Ω
R21 78.7Ω
C56 .01
MC60COM (47 A,B)
MC60-Ø (46 A,B)
MC60-1 (1C2) .5V P-P
MC60-COM (1C2)
MC30-0 (38 A,B)
MC30-1 (39 A,B)
INT 10 (43 A,B) REF OUT
MC0.1 (1DT)
MC0.1 (21 A,B)
MC0.5 (18A)
MCCOM (18B)
SYNPR-Ø (14B) [CI2]
LOCK-Ø (15B) [CI1]
CAUTION-Ø (15A) [CIØ]

OPTION ONLY
L7 1.5 uh
T3
C77 220 pf
C78 220 pf
R68 499Ω
R69 499Ω
C76 .01
ICF11
49A 10 MHz
48A
2-5V P-P
C48 .01
R33 249Ω
7404 ICD11
R20 301Ω

REF DIVIDERS
74LS290 ICC11
74LS290 ICC13
ICE13 74LS74
PUP1
REF SELECT
51.1Ω R34
7404 ICD11
TTL

+5 TTL
C60 .01
CR10
R35 1K
R36 2K
C61 .01
REF IN (29AB) EXT CLK 10MHz ±3PPM (1VRMS)
C57 .01
C58 10pf
C59 .01
R37 33.2K
CR11
CR12
R39 499Ω
C62 .1/10V
R40 499Ω
ICF11 NC10116
C63 .01
L5 82 uh
7486 ICE11
C65 .01
+15
VBB
ICD9 741
R41 3.32K
R42 1.5 MEG
R43 4.99K
C64 .01
-15
EXT SIG LEVEL DET
+15V
150K R38

PUP
74LS74 ICE13
CR13
R47 249Ω
ICF13 NE555
C66 22 uf 15V
B3
LOCK DET.
1K R44
+5
150K R46
4.99K R45

-15V
R49 10K
CR14
R52 150K
R50 69.8K
3.92K R51
5.6 C68
.01 C67
R48 10K
R53 150K
741 ICD14
741 ICC14
C69 .1/20V
C70 .1/20V
+15 -15
R56 10K
4.99K R57
10K R58
CR15
CR16
CR17
R59 12.1K
2.86VDC
R60 1.5K
1.35VDC
R61 750Ω
33.2K R62
6.19K R63
5.6 C72
R64 392K
R65 1.5K
2.4VDC
CR18
VC10 (C8)
+5 TTLA
LOOPFILTER
VCO LINEARIZER
VCGRD C8

+5 LOOPFILTER
R54 2K
R55 2K
7438
ICG14
E3
E4
E5
E6

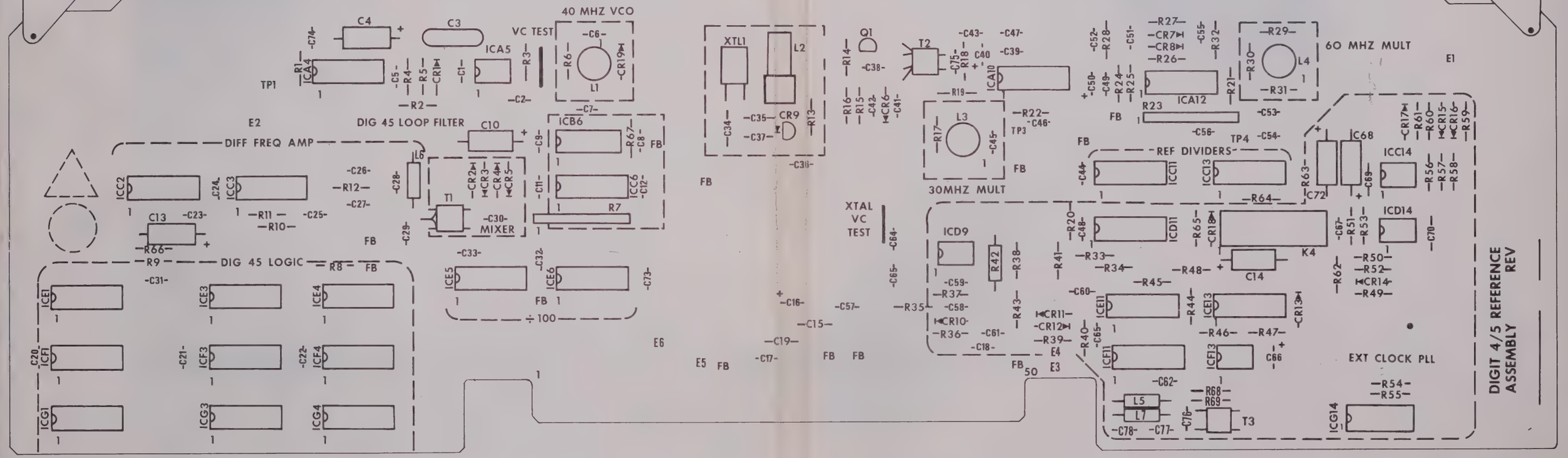
1. VC10 JUMPERS TO ITSELF ON SAME PCB, @ T.P. is -0.4v To -5 vdc RANGE (±100∼)
2. XTL 1: 10.00 MHz CRYSTAL PER SPEC.
3. DIODES UNMARKED ARE FD6666
4. ALL .001, .01 & .1 CAPS ARE CERAMIC DISC.
5. USE FERRITE BEAD NO. 3100-00-0002.

NOTE. UNLESS OTHERWISE SPECIFIED

LOCK -Ø	CAUT -Ø	MEANING
0	0	(NEVER HAPPENS)
0	1	HAPPY - EXT STD
1	0	ALARM - PROBLEM
1	1	HAPPY - INT STD

LAST REF. DES. USED: R69 Q1 E6 C78 L7 XTL1 CR19 T3 TP4
1 RELAY, REF K4

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN RO	DATE 6-11-76	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR Tom Sailor	SEPT 7/77	TITLE SCHEMATIC REFERENCE FREQ. DIG 4/5 REF PCB
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172 A / DWG NO. 0103-00-0501 / REV E
	SCALE		CODE IDENT 23338 / SHEET 2 OF 2



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROTENGR		TITLE ASSEMBLY DIGITS 4 & 5 REFERENCE ASSY.
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		
	DO NOT SCALE DWG		MODEL NO 172A / DWG NO 0101-00-0501 / REV
	SCALE		CODE IDENT 23338 / SHEET OF

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG,DIGIT 4-5	0101-00-0501	WVTK	0101-00-0501	1
NONE	SCHEMATIC,DIGIT 4-5	0103-00-0501	WVTK	0103-00-0501	1
T1	TRANSFORMER 2:1CEN	172-538	WVTK	1204-00-0538	1
T2	TRANSFORMER	172-540	WVTK	1204-00-0540	1
L1	COIL,40MC VCO	172-541	WVTK	1204-00-0541	1
L3	COIL,30MC MULT	172-543	WVTK	1204-00-0543	1
L4	COIL,60MC MULT	172-544	WVTK	1204-00-0544	1
L2	COIL,XTAL TUNE	1204-00-0627	WVTK	1204-00-0627	1
NONE	SHIELD,SYNTH	1400-00-6193	WVTK	1400-00-6193	1
NONE	SHIELD,OSC	1400-00-6631	WVTK	1400-00-6631	1
C56	CAP,CER,10PF,1KV	DD-100	CRL	1500-01-0011	1
C12 C30 C34 C55	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	4
C1 C11 C2 C24 C25 C26 C27 C31 C41 C42 C43 C44 C47 C48 C49 C5 C52 C56 C57 C59 C60 C61 C63 C64 C65 C67 C74 C9	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	28
C17 C18 C20 C21 C22 C23 C32 C33 C39 C62 C7 C73 C8	CAP,CER,.1MF,10V	UK10-104	ARCO	1500-01-0412	13

WAVETEK PARTS LIST	TITLE PCA,4TH/5TH FREQ REF	ASSEMBLY NO. 1100-00-0501 PAGE: 1	REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C15 C19 C69 C70	CAP,CER,.1MF,20V	UK20-104	ARCO	1500-01-0413	4
C51	CAP,CER,15PF,1KV	DD-150	CRL	1500-01-5011	1
C46	CAP,MICA,100PF,500V	DM15-101J	ARCO	1500-11-0100	1
C53	CAP,MICA,15PF,500V	DM15-150J	ARCO	1500-11-5000	1
C28 C29 C6	CAP,MICA,150PF,500V	DM15-151J	ARCO	1500-11-5100	3
C45	CAP,MICA,30PF,500V	DM15-300J	ARCO	1500-13-0000	1
C34 C38	CAP,MICA,39PF,500V	DM15-390J	ARCO	1500-13-9000	2
C75T	CAP,MICA,56PF,500V	DM15-560J	ARCO	1500-15-6000	1
C37	CAP,MICA,68PF,500V	DM15-680J	ARCO	1500-16-8000	1
C35 C54	CAP,MICA,82PF,500V	DM15-820J	ARCO	1500-18-2000	2
C3	CAP,MYLAR,.022MF10UV	225P22391MD3	SPRAG	1500-42-2314	1
C16 C40 C50 C66	CAP,TANT,.22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	4
C10 C13 C14 C4 C68 C72	CAP,TANT,5.6MF,35V	150D565X9035B2	SPRAG	1500-75-6502	6
NONE	DIGIT 4-5	1700-00-0501	WVTK	1700-00-0501	1
L5	CHOKE,82MH,5%	1537-72	DLVAN	1800-00-0005	1
L6	CHOKE,.33MH,5%	1537-04	DLVAN	1800-00-0009	1
NONE	SKT,IC,16PIN	DILB-16P-108	BURND	2100-03-0028	1

WAVETEK PARTS LIST	TITLE PCA,4TH/5TH FREQ REF	ASSEMBLY NO. 1100-00-0501 PAGE: 2	REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	PIN,MALE	61182-2	AMP	2100-05-0020	2
XTL1	CRYSTAL,10MHZ	172-010	WVTK	2300-99-0007	1
NONE	STANDOFF	8S5368-3C-5A	UNICP	2800-05-6114	5
NONE	PC BD EJECTOR	103 BROWN	CALMK	2800-07-0009	2
NONE	COIL SHIELD 3/4"	734-21	AUWA	3000-00-0015	3
NONE	BALUN CORE	2873000902	FAIRIT	3100-00-0002	12
K4	RELAY,REED,FORM=A	RA3014-1051	ETROL	4500-00-0007	1
R16 R24 R25	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	3
R35 R4 R44 R66 R8 R9	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	6
R15 R48 R49 R56 R58 R6	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	6
R59	RES,MF,1/8W,1%,12.1K	RN55D-1212F	TRW	4701-03-1212	1
R31	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	1
R60 R65	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	2
R38 R46 R52 R53	RES,MF,1/8W,1%,150K	RN55D-1503F	TRW	4701-03-1503	4
R27	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	1
R36 R54 R55	RES,MF,1/8W,1%,2K	RN55D-2001F	TRW	4701-03-2001	3
R14 R2	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	2

WAVETEK PARTS LIST	TITLE PCA,4TH/5TH FREQ REF	ASSEMBLY NO. 1100-00-0501 PAGE: 3	REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R19 R26 R33 R47	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	4
R67	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	1
R17 R20	RES,MF,1/8W,1%,301	RN55D-3010F	TRW	4701-03-3010	2
R41	RES,MF,1/8W,1%,3.32K	RN55D-3321F	TRW	4701-03-3321	1
R37 R62 R64	RES,MF,1/8W,1%,33.2K	RN55D-3322F	TRW	4701-03-3322	3
R51	RES,MF,1/8W,1%,3.92K	RN55D-3921F	TRW	4701-03-3921	1
R10 R11 R22 R29 R30 R32 R39 R40	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	8
R28 R43 R45 R5 R57	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	5
R13	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
R12 R18 R34	RES,MF,1/8W,1%,51.1	RN55D-51R1F	TRW	4701-03-5119	3
R63	RES,MF,1/8W,1%,6.19K	RN55D-6191F	TRW	4701-03-6191	1
R3	RES,MF,1/8W,1%,6.98K	RN55D-6981F	TRW	4701-03-6981	1
R50	RES,MF,1/8W,1%,69.8K	RN55D-6982F	TRW	4701-03-6982	1
R61	RES,MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	1
R21	RES,MF,1/8W,1%,78.7	RN55D-78R7F	TRW	4701-03-7879	1
R42	RES,MF,1/2W,1%,1.5M	RN65D-1504F	TRW	4701-23-1504	1
R23 R7	RES MODULE	4310M-101-471	BOURN	4770-00-0009	2

WAVETEK PARTS LIST	TITLE PCA,4TH/5TH FREQ REF	ASSEMBLY NO. 1100-00-0501 PAGE: 4	REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
CR19	DIODE	141	ITT	4803-02-0141	1
CR9	DIODE	MV2109	MOT	4803-02-2109	1
CR1 CR10 CR11 CR12 CR13 CR14 CR15 CR16 CR17 CR18 CR6	DIODE	FD-6666	FAIR	4807-02-6666	11
CR7 CR8	DIODE	5082-2811	HP	4809-02-2811	2
CR2 CR3 CR4 CR5	DIODE,SET,5082-2811 QTY:4:4809-02-2811	4898-00-0012	WVTK	4898-00-0012	1
Q1	TRANS	2N3903	FAIR	4901-03-9030	1
ICF13	IC	NE555V	SIG	7000-05-5500	1
ICA5 ICC14 ICD14 ICD9	IC	MA-741	FAIR	7000-07-4100	4
ICF1	IC	74S02	SIG	8000-74-0201	1
ICD11	IC	7404	TI	8000-74-0400	1
ICG14	IC	7438	TI	8000-74-3800	1
ICE1	IC	7474	TI	8000-74-7400	1
ICE13	IC	74LS74	TI	8000-74-7410	1
ICE11	IC	7486	TI	8000-74-8600	1
ICC2	IC	MC10125P	MOT	8001-01-2500	1
ICE5 ICE6	IC	MC10138P	MOT	8001-01-3800	2

WAVETEK PARTS LIST	TITLE PCA,4TH/5TH FREQ REF	ASSEMBLY NO. 1100-00-0501 PAGE: 5	REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
ICG4	IC	74LS139M	SIG	8007-41-3910	1
ICG1	IC	74S140	TI	8007-41-4001	1
ICE4 ICF4	IC	74LS175	TI	8007-41-7510	2
ICE3 ICF3 ICG3	IC	74LS192	TI	8007-41-9210	3
ICC11 ICC13	IC	74LS240	TI	8007-42-9010	2
IC86	IC	MC1648P	MOT	8100-16-4810	1
ICA4	IC	MC4044P	MOT	8100-40-4400	1
ICA10 ICA12 ICC3 ICC6 ICF11	IC,SEL,MC10116P QTY:1:8001-01-1600	8200-00-0012	WVTK	8200-00-0012	5

WAVETEK PARTS LIST	TITLE PCA,4TH/5TH FREQ REF	ASSEMBLY NO. 1100-00-0501 PAGE: 6	REV D

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST DIGITS 4&5/ REFERENCE
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO. 172A / DWG NO. 1100-00-0501 / REV D
	SCALE		CODE IDENT 23338 / SHEET OF

Table A-1. American Standard Code for Information Interchange (ASCII)

ASCII Codes

Binary Bit 7	0	0	0	0	1	1	1	1
Binary Bit 6	0	0	1	1	0	0	1	1
Binary Bit 5	0	1	0	1	0	1	0	1
Bit 4 / Bit 3 / Bit 2 / Bit 1 / Hex	0	1	2	3	4	5	6	7
0 0 0 0 / 0	NUL	DLE	SP	0	@	P	\	p
0 0 0 1 / 1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0 / 2	STX	DC2	"	2	B	R	b	r
0 0 1 1 / 3	ETX	DC3	#	3	C	S	c	s
0 1 0 0 / 4	EOT	DC4	$	4	D	T	d	t
0 1 0 1 / 5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0 / 6	ACK	SYN	&	6	F	V	f	v
0 1 1 1 / 7	BEL	ETB	'	7	G	W	g	w
1 0 0 0 / 8	BS	CAN	(	8	H	X	h	x
1 0 0 1 / 9	HT	EM	)	9	I	Y	i	y
1 0 1 0 / A	LF	SUB	*	:	J	Z	j	z
1 0 1 1 / B	VT	ESC	+	;	K	[	k	[
1 1 0 0 / C	FF	FS	,	<	L	\	l	:
1 1 0 1 / D	CR	GS	–	=	M	]	m	]
1 1 1 0 / E	S0	RS	.	>	N	↑	n	~
1 1 1 1 / F	S1	US	/	?	O	←	o	DEL

NUL = All zeros
SOH = Start of heading
STX = Start of text
EOT = End of transmission
ENQ = Enquiry
ACK = Acknowledgement
BEL = Bell or attention signal
BS = Back space
HT = Horizontal tabulation
LF = Line feed
VT = Vertical tabulation
FF = Form feed
CR = Carriage return
SO = Shift out
S1 = Shift in
DLE = Data link escape
DC 1 = Device control 1
DC 2 = Device control 2
DC 3 = Device control 3
DC 4 = Device control 4
NAK = Negative acknowledgement
SYN = Synchronous/idle
ETB = End of transmitted block
CAN = Cancel (error in data)
EM = End of medium
SUB = Start of special sequence
ESC = Escape
FS = Information file separator
GS = Information group separator
RS = Information record separator
US = Information unit separator
DEL = Delete

For GPIB:

DC4	=	DCL	Device clear	Universal Command Group
DC1	=	LLO	Local lockout	
NAK	=	PPU	Parallel poll unconfigure	
EM	=	SPD	Serial poll disable	
CAN	=	SPE	Serial poll enable	
SOH	=	GTL	Go to local	Address Command Group
EOT	=	SDC	Selected device clear	
ENQ	=	PPC	Parallel poll configure	
PS	=	GET	Group execute trigger	
HT	=	TCT	Take control	

APPENDIX B

Table B-1. Programming Command Summary

Control and Data Names	Model 172A Key	ASCII Character
Invert and minus	+/–	–
Decimal point	.	.
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
Amplitude	AMPL	A
Operating mode	MODE	B
Function (waveform)	FUNC	C
Reference offset	OFST	D
X 10 multiplier	EXP	E
Frequency	FREQ	F
Bus address status	ADR	G
Execute	EXEC	I
50Ω load condition	OUTP	P
Recall commands	CMD RCL	R
Symmetry	SYM	S
Amplitude definition	AMPL DEF	V
Display		'
Equate		=
Talk response	TLK	T
End of string	TRM	X
Service request	SRQ	Q
Store setting	STOR SET	M
Recall setting	RCL SET	Y
Next setting	NEXT SET	W

Number of Significant Digits	
Frequency	5 floating (6 when overranging, 10 MHz)
Amplitude	3 floating (4 when overranging, 10V p-p)
Offset	3 floating
All other	1 floating

SRQ (Q) Code	
Off	0
Enabled	1

Function (C) Codes	
Sine	0
Triangle	1
Square	2
None	3
DC	4
+ Pulse	6
– Pulse	7

Mode (B) Codes	
Continuous	0
Triggered	1
Gated	2
Synthesized	3
Triggered haverwave	4
Gated haverwave	5
External phase lock	6

Output Load (P) Codes	
Load out, output on	0
Load in, output on	1
Load out, output off	2
Load in, output off	3

Symmetry (S) Codes	
50%	0 or 5
10% thru 90%	1 thru 9

Unit (G) Codes	
All units deselected	0
Unit 1 selected	1
(etc., thru 9)	

Ampl Def (V) Codes	
V p-p into 50Ω	0
Vrms	1
dBm (50Ω)	2

Talk (T) Codes	
Status	0
Error status	1
SRQ reason	2
Current equates	3
Last setting	4

APPENDIX C

Table C-1. 172A Programming Examples

In the following examples, the 172A GPIB address switches are set to 00001. Therefore, the 172A's address on the HP9825 calculator is 701 (the 7 selects the GPIB interface card, and the 01 selects the 172A). Also, the 172A's address on the HP9830 calculator is then "!" (Listen address, ASCII exclamation point) or "A" (Talk address, ASCII letter A).

Example 1. Sweep amplitude from 1 to 11 volts in 10 millivolt steps.

Program for the HP9825 (HPL Language).

Program	Remarks
0: wrt 701, "D0F1E4B0C1P1S3"	Set up other 172A waveform parameters: 0 volts offset, 10 kHz frequency, continuous mode, triangle waveshape, load and output connected, and 30% symmetry. Note that since the Execute action (designated by the letter "I") is not programmed, this information is not yet programmed into the waveform generator circuits. This will happen when the first amplitude is programmed.
1: 1 →A	The variable A will be used to hold the current value of the amplitude being sent to the instrument.
2: wrt 701, "A", A, "I"	Send amplitude value to 172A. This is done by sending first the ASCII letter A, then the amplitude in variable A, followed by the letter I which causes the Execute action, which transfers the information programmed since the last Execute was sent to the waveform generator circuits.
3: A+.01 → A	Increment amplitude variable by 10 millivolts.
4: if A<=11; gto 2	Test if value of amplitude variable is less than or equal to 11 volts. If so, go back to statement 2 and send another amplitude. If not, proceed to statement 5.
5: stp	Stop program.

Program for the HP9830 (BASIC Language).

1000 CMD "?U!", "D0F1E4B0C1P1S3"	Set up other 172A waveform parameters: 0 volts offset, 10 kHz frequency, continuous mode, triangle waveshape, load and output connected and 30% symmetry. Note that since the Execute action (designated by the letter "I") is not programmed, this information is not yet programmed into the waveform generator circuits. This will happed when the first amplitude is programmed.
1010 FOR A = 1 TO 11 STEP .01	The variable A will be used to hold the current value of the amplitude being sent to the instrument.
1020 CMD "?U!"	
1030 OUTPUT (13, *) "A", A, "I"	Send amplitude value to 172A. This is done by sending first the ASCII letter A, then the amplitude in variable A, followed by the letter I which causes the Execute action, which transfers the information programmed since the last Execute was sent to the waveform generator circuits.

Table C-1. 172A Programming Examples (Continued)

Program	Remarks
1040 NEXT I	Go increment A by 10 millivolts and test if 11 volts have been reached.
1050 STOP	Stop program.
Example 2. Testing SRQ bit, polling, and reading error message from the 172A.	
Program for the HP9825(using the rds function)	
0: dim E$ [50]	
1: wrt 701, "C30"	Cause an error in the 172A so that it will request service.
2: if bit (7, rds (7)); gto 5	Wait at statement 2 until SRQ comes on.
3: dsp "SRQ NOT ON"	
4: gto 2	
5: dsp "SRQ ON"	
6: wrt 701, "T1"	Set 172A Talk message response setting to select the error message. It is necessary to do this before polling because the 9825 polling function sends the instrument talk address before the Serial Poll Enable (SPE) command. Thus, the 172A sees itself briefly addressed as a talker and fetches the selected talk message at that time.
7: rds (701) ⟶ A	Poll 172A and put its status byte in the variable A.
8: if A=69 gto 10	Test if correct status byte (69 = decimal equivalent of ASCII letter E).
9: dsp "BAD STATUS BYTE"; stp	If not, status byte is bad.
10: red 701, E$	Read error string into the string variable E$.
11: dsp E$	Display error string. Should look like E^1^C.
12: stp	
Program for HP9830.	
1000 DIM E$ [50]	
1010 CMD "?UI", "C30C"	Cause an error in the 172A so that it will request service.
1020 IF STAT13<=0 THEN 1050	Wait at statement 1020 until SRQ comes on.
1030 DISP "SRQ NOT ON"	
1040 GO TO 1020	
1050 DISP "SRQ ON"	

Table C-1. 172A Programming Examples (Continued)

Program	Remarks
1060 CMD "?U"	Set up calculator to talk for sending commands.
1070 FORMAT 5B	Binary format for sending commands.
1080 OUTPUT (13,1070) 256, 95, 53, 24, 65, 512	Perform the following: turn on ATN line; send UNTALK command; send calculator listen address (so calculator can receive status byte); send Serial Poll Enable (SPE) command; send 172A's talk address, which commands it to send its status byte to the calculator; finally, turn off ATN. Note that the 172A's talk address is sent after the SPE command; this ensures that the instrument will not try to access a talk message during a poll.
1090 A=RBYTE13	Poll 172A and put its status byte in the variable A.
1100 IF A=69 THEN 1130	Test if correct status byte (69 = decimal equivalent of ASCII letter E).
1110 DISP "BAD SRQ BYTE"	If not, status byte is bad.
1120 STOP	
1130 OUTPUT (13, 1070) 256, 95, 25, 512	Finish poll by unaddressing 172A (with 95) and sending a Serial Poll Disable command (25).
1140 CMD "?5A"	Address 172A to talk and calculator to listen.
1150 ENTER (13, *) E$	Read error string into the string variable E$.
1160 DISP E$	Display error string. Should look like E ^1^C.
1170 STOP	

Example 3. Reading Contents of Stored Settings Into Calculator.

Program for the HP9825.

0: dim S$ [80]	
1: wrt 701, "T0Q1Y", A	Initialize: Select talk response zero, which reports back a condensed reading of amplitude, offset, frequency, mode, function, load, and symmetry. Also, enable GPIB Service Request (SRQ) for errors and recall the stored setting selected by the value in the variable A, which has previously been set to the lowest numbered setting to be read.
2: red 701, S$	Read program information just recalled into the variable S$.
3: wrt 701, "W"	Command 172A to advance to and recall next program.
4: (instructions to save S$ on tape or other storage)	
5: wait (100)	Insure that 100 ms have elapsed since the "W" was sent to allow time for the SRQ to be valid. This statement may be unnecessary if statement 4 lasts longer than 100 ms.

Table C-1. 172A Programming Examples (Continued)

Program	Remarks
6: if not bit (7, rds (7)); gto 2	Test if SRQ line is on. If not, go to statement 2 and read next program. If on, the last setting has been read.
Program for the HP9830.	
1000 DIM S$ (80)	
1010 CMD "?U!", "T0Q1Y"	Initialize: Select talk response zero, which reports back a condensed reading of amplitude, offset, frequency, mode, function, load, and symmetry. Also, enable GPIB Service Request (SRQ) for errors and recall the stored setting selected by the value in the variable A, which has previously been set to the lowest numbered setting to be read.
1020 OUTPUT (13, *) A	
1030 CMD "?A5"	Address 172A to talk and 9830 to listen.
1040 ENTER (13, *) S$	Read program information just recalled into the variable S$.
1050 CMD "?U!", "W"	Command 172A to advance to and recall next program.
1060 (instructions to save S$ on tape or other storage)	
1070 WAIT (100)	Insure that 100 ms have elapsed since the "W" was sent to allow time for the SRQ to be valid. This statement may be unnecessary if statement 1060 lasts longer than 100 ms.
1080 IF STAT13>1 THEN 1040	Test if SRQ line is on. If not, go to statement 1040 and read next program. If on, the last setting has been read.

MODEL 172A OPTION 004

The 154/157 Emulator is a software program which runs in the Wavetek 172A, causing it to operate as a Wavetek 154 or 157 function generator.

1 EMULATOR INITIAL CHECKOUT

1.1 154 Emulation

The 172A with rear panel equipped connectors, J2 and J3, is ready to emulate a low-true-input or high-true-input version of the 154, whichever was ordered. Turn power on and verify that the display reads "154 MODE". Connect your 154 programming cables to J2 and J3 and follow normal 154 checkout procedures. If "157 MODE" is displayed or the 172A does not correctly respond to programming, refer to paragraph 1.3.

1.2 157 Emulation

The 172A with adapter cable (which channels J2 and J3 to a single connector that mates with your 157A programming connector) is ready to emulate a low-true-input (157A) or high-true-input (157D) version of the 157. Turn power on and verify that the display reads "157 MODE". Connect your 157 programming cable to the 172A, via the adapter cable, and follow normal 157 checkout procedures. If "154 MODE" is displayed or the 172A does not correctly respond to programming, refer to paragraph 1.3.

1.3 Incorrect Emulation or Operation

If the display shows the incorrect mode when power is turned on, or the operation is nonsensical when programmed, a DIP switch on the decoder circuit board is probably set incorrectly. The decoder board also contains the rear panel connectors J2 and J3. Access to the switch is through the cooling vents in the bottom cover. Reset the switch as desired.

Switch	Emulation
4	Open - 154 157
5	Open - Low True Logic Input High True Logic Input

2 OPERATION

Upon power-up, the 172A reads the value at the decoder switch J3-17 and, depending on its value, puts itself into 154 or 157 emulation mode with control of all settings from the J2 and J3 connectors.

From this point, control of a setting can be changed to the keyboard (refer to Remote/Local Mode of Settings). There is also a 172A mode of operation which allows symmetry setting and more of a variety of modes and functions (refer to paragraph 2.3).

2.1 Emulation of 154

Performance
Frequency: 100E–6 to 10E6 Hz.
Amplitude: 1 mV to 14.99V.
Offset: 0 to ±5.00V.
Mode: Continuous, triggered, gated.
Function: Sine, triggered, square, dc.

Differences

1. DC mode output impedance is 50Ω, not $< 1\Omega$.
2. Trigger/gate input is a T^2L pulse asserted on a negative transition.
3. Selective remote operation is controlled at the front panel to inhibit remote control from one or more inputs.
4. Internal 172A load may be inserted or removed at the front panel.
5. If a synthesizer is installed, synthesized mode will be substituted for continuous when selected manually. This results in 0.0005% frequency accuracy for frequencies above 10 Hz.
6. Remote out is always +3.5V.
7. Requires 5¼ in. panel height, 22 in. depth.
8. Control is optically isolated from analog ground.
9. AM capability not provided.

2.2 Emulation of the 157

Performance
Frequency: 1E–3 to 1E6 Hz.
Amplitude: 10 mV to 14.99V.
Offset: None.
Mode: Continuous, synthesized, gated.
Function: Sine, square, triangle.

Differences

1. Trigger/gate input is a T^2L signal asserted on a negative transition.
2. Sync out is a T^2L signal.
3. Selective remote capability allows control of one or more functions from the front panel.
4. VCG input impedance 5 kΩ, not > 10 kΩ.
5. An internal 50Ω load can be manually inserted.
6. Frequency synthesis is from 10 Hz to 1E6 Hz.
7. Control is optically isolated from analog ground.

2.3 Selection of 154, 157 or 172A Mode

The instrument powers up in the 154 or 157 mode. To put the instrument into the 172A mode, press AMPL DEF followed by the value 91. To return to the 154/157 mode, press AMPL DEF followed by the value 90.

2.4 Remote/Local Mode of Settings

Upon power-up, the instrument is in the 154 or 157 mode with all settings remoted. In remote mode, a setting is controlled exclusively from the back connectors. In local mode, control is exclusively from the front keyboard. To change the remote/local mode of a setting, press front keyboard AMPL DEF key followed by a two digit number:

Digit 1, Parameter
1 All Parameters
2 Offset
3 Frequency
4 Amplitude
5 Function
6 Mode

Digit 2, Remote or Local
Odd Digit: Switch to remote.
Even Digit: Switch to local.

2.5 Front Panel Programming

Refer to the basic 172A User's Manual for front panel operation. Exceptions applicable to the 154 and 157 are detailed here.

Function
Press FUNC followed by a numeric value.

154	157	172A
0 Sine	1 Sine	0 Sine
1 Triangle	2 Triangle	1 Triangle
2 DC	3 Sine	2 Square
3 Square	4 Square	4 DC
	5 Triangle	
	6 Triangle	
	7 Sine	

Mode
Press MODE followed by a numeric value.

154	157	172A
0 Continuous	0 Continuous	0 Continuous
1 Gated	1 Synthesized	1 Triggered
2 Off	2 Gated	2 Gated
3 Triggered	3 Gated	3 Synthesized
4 Synthesized		4 Triggered Haverwave
		5 Gated Haverwave
		6 External Phase Locked

Output/Load
Press OUTP followed by a numeric value. This affects only the load, if in 154 mode with the MODE setting remoted; the output state (ON/OFF) is controlled by the remote MODE input.

0 Load Out, Output On
1 Load In, Output On
2 Load Out, Output Off
3 Load In, Output Off

3 CIRCUIT DESCRIPTION

Model 172A will emulate Wavetek instruments 154 or 157 by installing Option 004. The option consists of an interface card, an output decoder mounted on the rear of the instrument, seven PROMs installed on the ROM board and a 157 adapter cable. For 157 emulation, the synthesizer option (002) is also installed. Wavetek Models 154 and 157 are parallel entry devices requiring 48 and 45 data lines, respectively, coded in BCD format high or low true. The 172A emulator determines the type of instrument and the polarity (1 = low or 1 = high) from a DIP switch or from two additional pins in the interface connector.

The 172A connector is composed of two 36 pin ribbons (Amphenol 57-30360) in the same configuration as a Model 154. Two additional pins are defined on J3. Pin 17, if open, indicates 154 mode. Pin 17 connected to ground (pin 18) indicates 157 mode. Pin 16 indicates input polarity (open indicates low true data; ground indicates high true data). A DIP switch on the decoder board normally performs this open or grounding function (refer to paragraph 1.3).

All input lines are connected to +5V through 10 kΩ resistors; therefore, any open pin will be considered a high. The polarity pin does not affect the instrument selection (pin 17) polarity. A ground on pin 17 always selects 157 mode (regardless of the state of pin 16.

To emulate a 157, the synthesizer option (002) and an interface cable (between the 172A emulator connectors and the 157 connector) is supplied with the instrument.

In operation, the 154/157 Emulator scans the input connector (figure 1) one 4 bit character at a time, accumulates a data value for frequency, offset amplitude function and mode, stores the data in the 172A scratch pad and then initiates an execute to distribute the new setting to the analog section of the instrument. Note that no *direct* parallel operation is involved between the instrument and the controller. Approximately 6 to 15 ms are required to complete a scan and assume a new setting.

Table 1. 154/157 Emulator Interface Map

Address	154	157
0	FREQ MSD	FREQ D5
1	FREQ MMD	FREQ D4
2	FREQ LSD	FREQ D3
3	DC MSD	FREQ D2
4	DC MMD	FREQ D1
5	DC LSD	AMPL & FREQ OVERRNG
6	FREQ RNG	FREQ RNG
7	AMPL MSD	AMPL MSD
8	AMPL MMD	AMPL MMD
9	AMPL LSD	AMPL LSD
A	AMPL RNG	AMPL RNG
B	FUNC	FUNC
C	MODE	MODE
D		
E	DC SIGN	
F	INST & LOGIC CNTL REMOTE OUT	

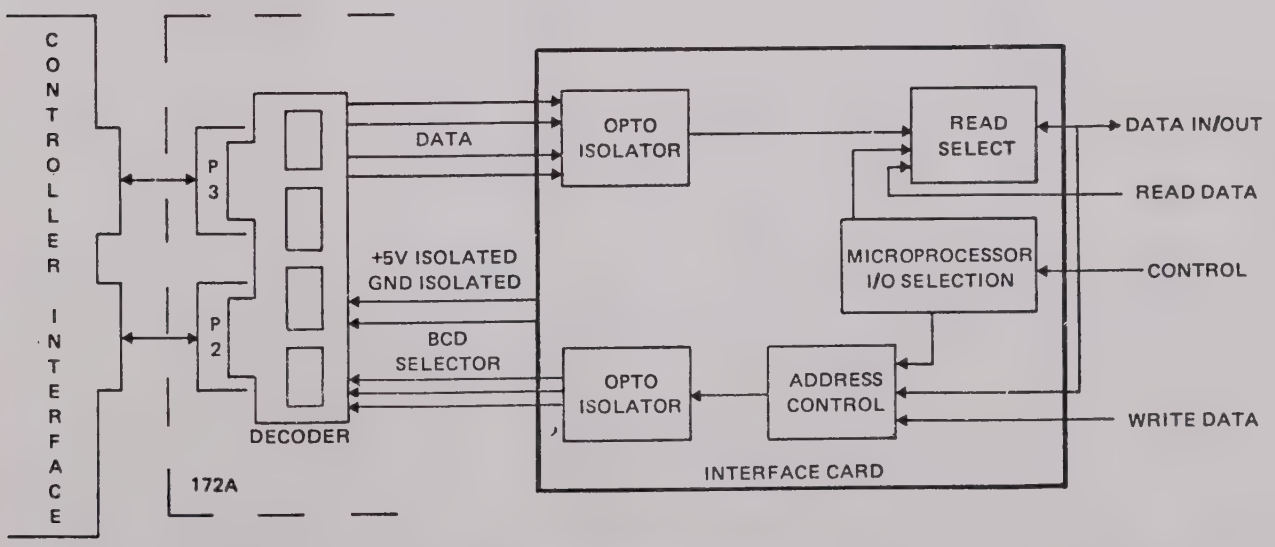
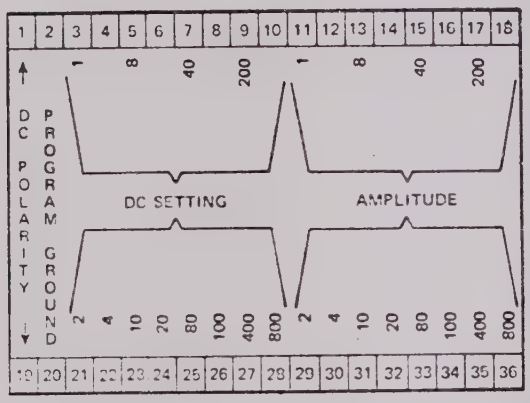


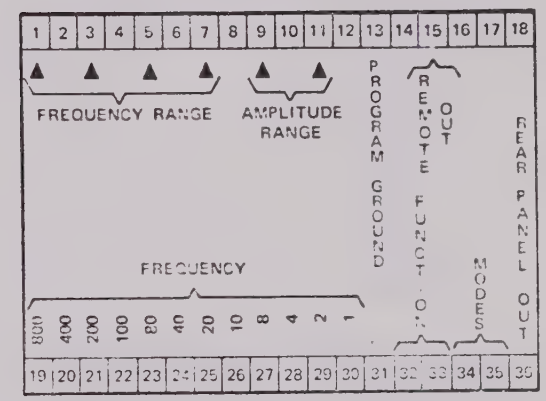
Figure 1. Emulator Interface

Control Connector Pin Layout

Plug J2 Mating Connector
Amphenol 57-30360 or equivalent



Plug J3 Mating Connector
Amphenol 57-30360 or equivalent



Truth Tables With Pin Assignments

DC Polarity	Program (Pin No.) 19 1
+	0 0
0	0 1
–	1 0

Frequency Range	Program (Pin No.) 7 5 3 1
0.001	0 0 0 0
0.01	0 0 0 1
0.1	0 0 1 0
1.0	0 0 1 1
10	0 1 0 0
100	0 1 0 1
1 K	0 1 1 0
10 K	0 1 1 1
.1 M	1 0 0 0
1 M	1 0 0 1

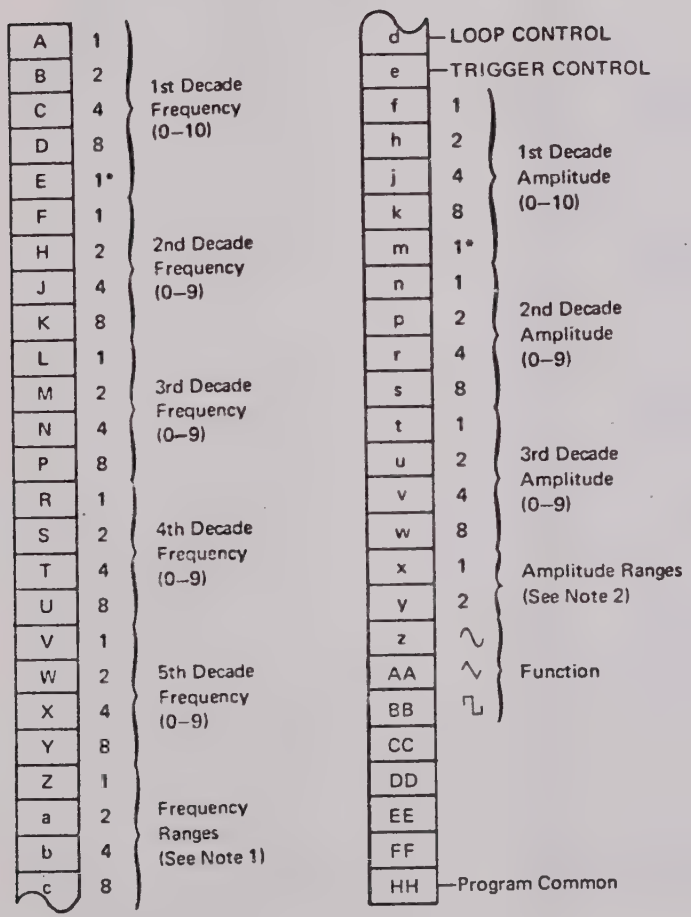
Amplitude Range	Program (Pin No.) 11 9
0.001	0 0
0.01	0 1
0.1	1 0
1.0	1 1

Function	Program (Pin No.) 33 32
∿	0 0
∿	0 1
DC	1 0
⊓	1 1

Mode	Program (Pin No.) 35 34
Continuous	0 0
Gated	0 1
No Output	1 0
Trigger	1 1

Figure 2. Model 154 Connectors and Input

Control Connector Pin Layout



NOTE 1

PROGRAM	FREQ RANGE
0	1000 μHz
1	10 mHz
2	100 mHz
3	1000 mHz
4	10 Hz
5	100 Hz
6	1000 Hz
7	10 kHz
8	100 kHz
9	1000 kHz

NOTE 2

PROGRAM	AMPL RANGE
0	10 mV
1	100 mV
2	1000 mV
3	10 V

To program "10", the code is 8, 1, and 1.

Figure 3. Model 157 Connector and Input

Table 2. 154/157/MUX/IC Pin Listing

154 Connectors		Bit	157 Connector		Bit	MUX Address	IC - Pin
J3 - 19	FREQ MSD	3	D	FREQ D5	3	0	6 - 4
- 20		2	C		2		7 - 4
- 21		1	B		1		8 - 4
- 22		0	A		0		9 - 4
J3 - 23	FREQ MMD	3	K	FREQ D4	3	1	6 - 3
- 24		2	J		2		7 - 3
- 25		1	H		1		8 - 3
- 26		0	F		0		9 - 3
J3 - 27	FREQ LSD	3	P	FREQ D3	3	2	6 - 2
- 28		2	N		2		7 - 2
- 29		1	M		1		8 - 2
- 30		0	L		0		9 - 2
J2 - 28	DC MSD	3	U	FREQ D2	3	3	6 - 1
- 27		2	T		2		7 - 1
- 9		1	S		1		8 - 1
- 26		0	R		0		9 - 1
J2 - 25	DC MMD	3	Y	FREQ D1	3	4	6 - 15
- 7		2	X		2		7 - 15
- 24		1	W		1		8 - 15
- 23		0	V		0		9 - 15
J2 - 5	DC LSD	3				5	6 - 14
- 22		2					7 - 14
- 21		1	E	FREQ OVERRNG			8 - 14
- 3		0	m	AMPL OVERRNG			9 - 14
J3 - 7	FREQ RNG	3	c	FREQ RNG	3	6	6 - 13
- 5		2	b		2		7 - 13
- 3		1	a		1		8 - 13
- 1		0	Z		0		9 - 13
J2 - 36	AMPL MSD	3	k	AMPL MSD	3	7	6 - 12
- 35		2	j		2		7 - 12
- 17		1	h		1		8 - 12
- 34		0	f		0		9 - 12
J2 - 33	AMPL MMD	3	s	AMPL MMD	3	8	2 - 4
- 15		2	r		2		3 - 4
- 32		1	p		1		4 - 4
- 31		0	r		0		5 - 4
J2 - 13	AMPL LSD	3	w	AMPL LSD	3	9	2 - 3
- 30		2	v		2		3 - 3
- 29		1	u		1		4 - 3
- 11		0	t		0		5 - 3

Table 2. 154/157/MUX/IC Pin Listing (Continued)

154 Connectors		Bit	157 Connector		Bit	MUX Address	IC - Pin
J3 - 11	AMPL RNG	1	y	AMPL RNG	1	A	4 - 2
- 9		0	x		0		5 - 2
J3 - 31			BB		⊓	B	3 - 1
- 33	FUNC	1	AA		∿		4 - 1
- 32		0	z		∿		5 - 1
J3 - 35	MODE	1	e	TRIG CONTROL		C	4 - 15
- 34		0	d	LOOP CONTROL			5 - 15
J2 - 19	DC ±	1				E	4 - 13
- 1		0					5 - 13
J3 - 17	INST CNTL	1				F	4 - 12
- 16	LOGIC CNTL	0					5 - 12
J3 - 15	REMOTE OUT						
- 13	PROG COM		HH	PROG COM			
J2 - 20	PROG COM						
- 18	GND						
J3 - 18	GND						

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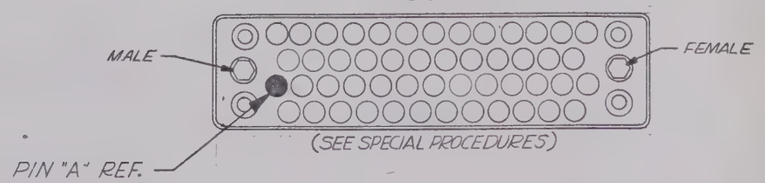
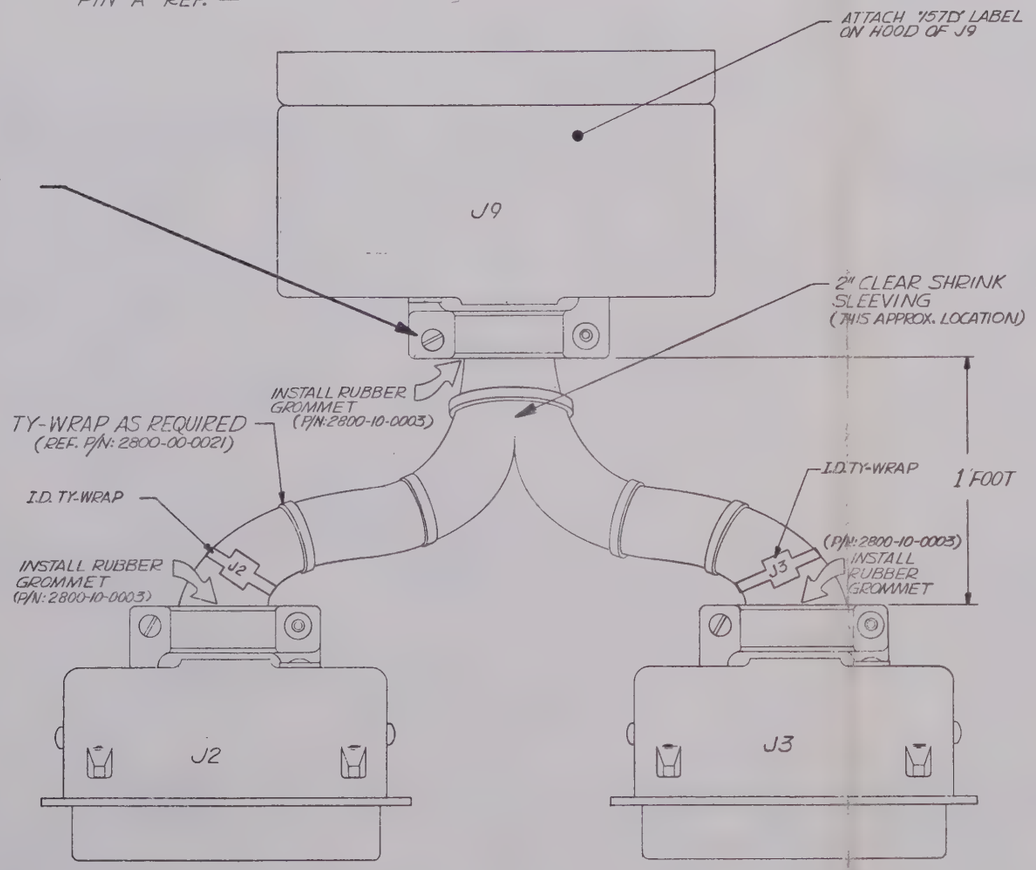
REV	ECN	BY	DATE	APP

(REF. P/N: 2100-02-0023)
J9





AMPH. 57-30360

AMPH. 57-30360

SPECIAL PROCEDURE REQUIRED FOR J9 CONNECTOR:

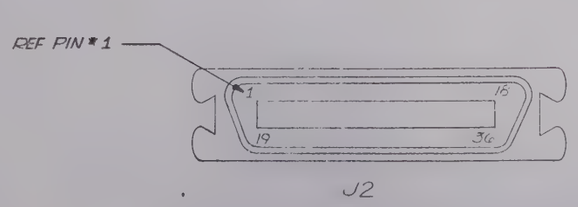
1. J9 CONNECTOR HOOD MUST HAVE SIDES CUT EVEN WITH HEIGHT OF ENDS
2. MALE GUIDE PIN GOES AT TOP OF CONN. (A)
3. USE #2 x 1/4" SCREWS, LOCK WASHERS AND NUTS TO INSTALL LOCK SPRINGS TO CONNECTOR
4. USE TY-WRAPS ABOUT EVERY 1 1/2"
5. FEED ALL WIRES THROUGH APPROPRIATE GROMMETS AS WELL AS CONNECTOR HOODS AND SHRINK SLEEVING.

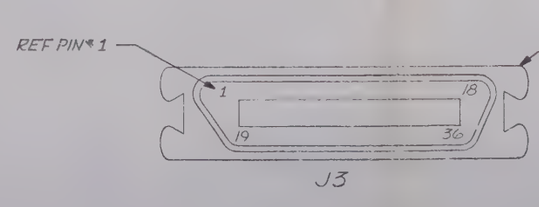
ALL WIRING TO "J9" CONN.

PIN	TO	WIRE COLOR	PIN	TO	WIRE COLOR
A	J3-22	BLK	BB	J3-31	WHT/BLK/GRN
B	J3-21	BRN	HH	J3-13	* BLU
C	J3-20	RED	a	J3-3	WHT/BLK/VIO
D	J3-19	ORG	b	J3-5	WHT/BLK/GRY
E	J2-21	YELL	c	J3-7	BLK
F	J3-26	GRN	d	J3-34	BRN
H	J3-25	BLU	e	J3-35	RED
J	J3-24	VIO	f	J2-34	ORG
K	J3-23	GRY	h	J2-17	YELL
L	J3-30	WHT	j	J2-35	GRN
M	J3-29	WHT/BLK	k	J2-36	BLU
N	J3-28	WHT/BRN	m	J2-3	VIO
P	J3-27	WHT/RED	n	J2-31	GRY
R	J2-26	WHT/ORG	p	J2-32	WHT
S	J2-9	WHT/YELL	r	J2-15	WHT/BLK
T	J2-27	WHT/GRN	s	J2-33	WHT/BRN
U	J2-28	WHT/BLU	t	J2-11	WHT/RED
V	J2-23	WHT/VIO	u	J2-29	WHT/ORG
W	J2-24	WHT/GRY	v	J2-30	WHT/YELL
X	J2-7	WHT/BLK/GRN	w	J2-13	WHT/GRN
Y	J2-25	WHT/BLK/RED	x	J3-9	WHT/BLU
Z	J3-1	WHT/BLK/ORG	y	J3-11	WHT/VIO
AA	J3-33	WHT/BLK/YELL	z	J3-32	WHT/GRY

1 UNUSED PINS ARE NOT SHOWN
2 22 GA. WIRE @ 1' LENGTHS TYPICAL (UNLESS OTHERWISE SPECIFIED)
* = 20 GA. WIRE, BLU. (GND.)

DELIVERED
MAR 15 1978
BY





ADDITIONAL PIN ASSIGNMENTS
1.) JUMPER J3-17 TO J3-18 (BARE WIRE)
2.) ADD WIRE J2-5 TO J3-16

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 2/6/78	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	ENGINEER		TITLE ASSEMBLY CABLE (157)
FINISH WAVETEK PROJ. #			MODEL NO 172
			DRAWING NO 1002-00-0157
			SCALE 1/1
			SHEET 1 OF 1

8 7 6 5 4 3 2 1

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REV	ECN	BY	DATE	APP

A94
A7
B11
ABUS5/
ABUS4/
ABUS3/
ABUS2/
ABUS1/
ABUS0/
B94
ABUS6/
E/NE
OPRE0/
A10
ONE
RD/WT
WRP
A12
B12
B10
OPACK/
IC25B 74LS02
IC26B 74LS30
IC24B 7438
IC14B 7438
IC24R 7438
IC25R 74LS02
IC25B 74LS02
IC24B 7438
IC24B 7438
IC14B 7438
IC24B 7438
+5V
R20 4.99K
CT/
Rd
R21 4.99K
WT/
R19 4.99K
R11 150
R13 6.19K
+5V ISO
IC19B
IC23B
B88
IS0
SA0
R24 90.9K
R15 150
R17 6.19K
IC21B
A87
IS1
SA1
R25 90.9K
R14 150
R16 6.19K
IC22B
B87
IS2
SA2
R29 90.9K
R10 150
R12 6.19K
IC20B
A86
IS3
SA3
R28 90.9K
IC23B
A88
IS3/
ISO+5
JNE
R18 4.99K
Rd
SA0
SA1
SA2
SA3
IC13B 74LS161
D0
D1
D2
D3
WWT/
CT/
R5 6.19K
R6 150
R3 6.19K
IC16B
DI0
A80
XDB0
R26 90.9K
R7 150
IC15B
DI1
B80
XDB1
R22 90.9K
R8 150
IC18B
DI2
A81
XDB2
R27 90.9K
R9 150
IC17B
DI3
P81
XT17
IC12B
B5
DBUS0/
A5
DBUS1/
B6
DBUS2/
A6
DBUS3/
+5V
A42,B49,A50,B50
A51,B51,A52,B52
C3 THRU C7
C9 .01uf
C1 33uf 10V
GND
A1 B1 A2 B2 A99
B99 A100 B100
I/O +5V
A63,B63,A77,A78,A79
C8 .01uf
C2 33uf 10V
ISO+5V
I/O GND
A62,B62,B77,B78,B79
ISO GND

SYNTH
LOAD
CI4
B44
CI3
B45
OPTIONAL

DELIVERED
MAR 15 1978

NOTE: UNLESS OTHERWISE SPECIFIED

DESIGNED	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROFESSOR		SCHEMATIC
	APPROVED		1574/1575 INTERFACE
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.03		
	DO NOT SCALE DWG	MODEL NO 172	DWG NO 0103-00-0491 REV
	SCALE	SIZE D	73330 SHT 1

8 7 6 5 4 3 2 1

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REV	ECN	BY	DATE	APP

157		154	J2
		DC ±Ø	1
			2
AMP OVER RNG m		DC LSDØ	3
			4
		DC LSD3	5
			6
FREQ D1 2	X	DC MMD 2	7
			8
FREQ D2 1	S	DC MSD1	9
			10
AMP LSDØ	t	AMP LSDØ	11
			12
AMP LSD3	w	AMP LSD3	13
			14
AMP MMD 2	r	AMP MMD2	15
			16
AMP MSD1	h	AMP MSD1	17
		GND	18
		DC ± 1	19
		PROG COM	20
FREQ OVER RNG	E	DC LSD 1	21
		DC LSD2	22
FREQ DIØ	V	DC MMDØ	23
FREQ D11	W	DC MMD 1	24
FREQ D13	Y	DC MMD 3	25
FREQ D2Ø	R	DC MSDØ	26
FREQ D22	T	DC MSD2	27
FREQ D23	U	DC MSD 3	28
AMP LSD1	u	AMP LSD1	29
AMP LSD2	v	AMP LSD2	30
AMP MMDØ	n	AMP MMDØ	31
AMP MMD1	p	AMP MMD1	32
AMP MMD3	s	AMP MMD3	33
AMP MSDØ	f	AMP MSDØ	34
AMP MSD2	J	AMP MSD2	35
AMP MSD3	K	AMP MSD3	36

157		154	J3
FRNG Ø	7	FRNG Ø	1
			2 < 4-14
FRNG 1	a	FRNG 1	3
			4 < 3-14
FRNG 2	b	FRNG 2	5
			6 < 2-14
FRNG 3	C	FRNG 3	7
			8 < 1-14
AMP RNGØ	X	AMP RNGØ	9
			10
AMP RNG 1	Y	AMP RNG 1	11
			12
PROG COM	HH	PROG COM	13
			14
		REMOTE OUT	15
		LOGIC CONT	16
		INST CONT	17
		GND	18
FREQ D5 3	D	FREQ MSD 3	19
FREQ D5 2	C	FREQ MSD 2	20
FREQ D5 1	B	FREQ MSD 1	21
FREQ D5 Ø	A	FREQ MSDØ	22
FREQ D4 3	K	FREQ MMD 3	23
FREQ D4 2	J	FREQ MMD 2	24
FREQ D4 1	H	FREQ MMD 1	25
FREQ D4 Ø	F	FREQ MMDØ	26
FREQ D3 3	P	FREQ LSD 3	27
FREQ D3 2	N	FREQ LSD 2	28
FREQ D3 1	M	FREQ LSD 1	29
FREQ D3 Ø	L	FREQ LSD Ø	30
⌐⌐	BB		31
~	Z	FUNC CØ	32
~	AA	FUNC C 1	33
LOOP CONT	d	MODE Ø	34
TRIG CONT	e	MODE 1	35
			36 <

RB
10K
+5V

SIP ALL INPUTS ON 74LS151

IC 9, IC 8, IC 7, IC 6, IC 5, IC 4, IC 3, IC 2 — 74LS151 (+5V, GND)

IC 5 — 74LS154

IS0 J1-12
IS1 J1-2
IS2 J1-11
IS3 J1-3
IS31 J1-1

IC 1 743B → XDB0 J1-22
IC 1 743B → XDB1 J1-15
IC 1 743B → 3
IC 1 743B → 11

J3-17
J3-16
LOGIC
OPEN = LO TRUE
CLOSED = HI TRUE

MODEL:
154 - OPEN
157 - CLOSED

ISO +5V → J1-19,20,21 ISO +5V
C2 Mou CAP .01uf
C1 33uf
ISO GND → ISO GND J1-16,17,18

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ERN
ECN

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN T.E.D.	DATE 9-16-77	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: SCHEMATIC 154/157 INTERFACE
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		
	DO NOT SCALE DWG		MODEL NO 172
	SCALE		DWG NO 0103-00-15125 REV A
			CODE IDENT 23338 SHEET 1 OF 1

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